REPORT

OF THE

13

COMMISSIONERS

APPOINTED TO INVESTIGATE THE

BITUMINOUS COAL MINES

OF

PENNSYLVANIA.

HARRISBURG:
B. F. MEYERS, STATE PRINTER.
1875

Digitized by the Internet Archive
in 2017 with funding from
This project is made possible by a grant from the Institute of Museum and Library Services as administered by the Pennsylvania Department of Education through the Office of Commonwealth Libraries

https://archive.org/details/reportofcommissi00penn_45

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met:

The undersigned, a commission appointed in pursuance of the provisions of the joint resolution of the General Assembly, approved the 16th day of March, A. D. 1874, would respectfully report:

That immediately upon the reception of our commissions from his Excellency, the Governor, we met in the city of Pittsburg, proceeded at once to organize and consider the nature of the duties we were called upon to perform under the provisions of the act authorizing our appointment. That act as found in "Laws of Pennsylvania" for 1874, pages 311 and 312, is as follows, viz:

"No. 1.

"Joint resolution providing for the appointment by the Governor of three commissioners to investigate the condition of the bituminous coal mines in this Commonwealth.

"WHEREAS, It is essential to the welfare of all classes that the Commonwealth, by wholesome laws enacted, should guarantee proper safeguards for the preservation of life and limb to those following the various avocations of life:

"*And whereas,* The coal miners engaged in mining coal throughout the bituminous coal regions of this State have, by numerous petitions and otherwise, complained to the Legislature thereof, that they are suffering to a great extent, both physically and mentally, while following their daily avocation, from an inadequacy of proper ventilation and drainage of mines:

"*And whereas,* Conflicting opinions and interests throughout said bituminous coal regions seem to indicate that existing laws relating to the ventilation of mines throughout certain sections of the Commonwealth are inapplicable to the bituminous regions; therefore,

"*Be it resolved, &c.,* That the Governor is hereby authorized to appoint a board of commissioners, to consist of three persons, who have a reputable practical knowledge of mines and mining throughout the bituminous coal regions of the State, whose duty it shall be to carefully and fully investigate the present condition of the bituminous coal mines, and ascertain whether the same are properly ventilated and drained, together with such other matters connected therewith as are calculated to preserve the health and secure the safety of persons employed therein; said commissioners to report the result of said investigation to the next Legislature.

"SECTION 2. That the said commissioners shall have full authority to enter, unmolested, any and all coal mines throughout the State, and shall be empowered to make such examinations therein, as in their judgment they may deem expedient; and for each day thus employed the said commissioners shall be paid the sum of five dollars per day, together with all

necessary expenses incurred while in the discharge of their duties, a record of which shall be kept by said commissioners, which shall be sworn to, when the same shall be paid by the State Treasurer, out of any money in the Treasury not otherwise appropriated, after approval by the proper accounting officer of the State: *Provided*, That the time occupied by said commissioners in said investigation shall not exceed one hundred days."

As this joint resolution constituted the authority under which we were to act, and the instructions as to the duties we were to perform, after careful consideration, we determined that, as the time allotted in which to do the work, was only one hundred days, and that time would be far too short to attempt an examination of all the mines, that our proper course would be to distribute the service over the whole field as far as possible, by taking in each county as many of the representative works as would in proportion to the extent of its development, constitute an equal division of the inquiry among all, so that our report might not show a full investigation of a few localities, to the neglect of others.

After entering upon the actual examination, however, we found ourselves confronted with another obstacle to an extended inquiry within the time, in the fact that owing to the extreme dullness of trade very many of the collieries, in almost every district, were standing idle. Within the time to which we were limited by the joint resolution, however, we made personal examination of mines, of which the notes of condition as found, are hereto appended.

As illustrating the significance of these notes, we may properly divide the mines into three classes, viz: Those worked on what may be generally termed no system; the block system, and the double heading system. In all of these systems, the means of producing a ventilating current, are either natural or artificial.

The mines generally in the counties of Beaver, Lawrence, Mercer, the Snow Shoe mines in Centre county, Huntingdon, Bedford, Blair and Fayette, all may be classed under the head of the first or no system. Butts mines, in Beaver county, are deserving of special mention here, as illustrating the character of this system, by the unhealthy condition in which we found them. The full length of the traveling ways, nearly a mile, were half boot up with mud and water, worked into a creamy consistence by tramping through it, the mules as they plunge through it throwing the mud in every direction. This, with ventilation of a similar character, no current of air any where found sufficient to move the anemometer in a mine working from 60 to an 100 miners, and fourteen mules and drivers, may be taken to constitute a whole, than which it would be difficult to conceive one more injurious to men working in it either physically or morally.

The next deserving notice as illustrative of this class, is Pearson, Bell & Co.'s mines, near New Castle, Lawrence county. Although not quite so bad as that last described, the air being better and freer from carbon, it is in a very unhealthy condition, both as to drainage and ventilation. Both the mines are drifts and might be properly drained and ventilated at very little cost.

In Mercer county mines, generally, no system is observed. Entries or headings are driven onward, and as fast as rooms are cut out men are set to work in them, sometimes twenty or thirty, or even a greater number, in this narrow heading of five feet high by seven feet wide, while the rooms must be driven distances varying from ten to thirty or more yards, and then cut over to the next room before any circulation is provided; and then only a displacement of air, caused by the motion of the cars in the entry, which drives it round the pillars.

As another illustration still, of this first class, we may mention Kimberly, Filers & Co.'s mines, No. 1, which get their supply of air from Philips, Pearce & Co.'s works adjoining, which necessarily reaches these works in an impure state after circulating through the other, and comes to them more or less loaded with black damp and other impurities, and constitutes the *fresh air used to ventilate them.* On nearing the head of these works we found it difficult to carry a lighted lamp, so much was the air charged with noxious vapors, and as this was the forepart of the day, its condition may be readily imagined after the middle of the day. In one part of these works, owing to the foulness of the air, the miners had been compelled to stop work for some days previous to our visit. The stable for mules is close by the bottom of the hoisting shaft, and the effluvia arising from them, owing to the smallness of the air current, penetrates to a considerable distance around, and to a person going down from the fresh air causes a very sickening sensation. The shaft purporting to be the escapement is used also as a pumping shaft, and at the bottom is placed the engine, furnace and boilers, with an iron chimney like a steamboat stack to carry the smoke out, but all poisonous gases generated in the mine, together with powder, smoke, &c., ascend by the shaft, while the ladders are of the most primitive fashion and anything but safe.

This description of escapement shaft will apply also to others in this valley, except that the engines, boilers, furnaces, &c., are generally at the top, the steam being conveyed down the shaft in pipes, and the exhaust steam ascending the shaft makes the air very hot. This, together with the poisonous gases generated in the mines, the powder smoke and the laborious effort required in climbing the ladders, render them very injurious to health, and anything else than a safety escapement. Beside all this they are nearly filled up with pumps, steampipes, ladders, landings for ladders, fastenings for pipes, pumps, &c., leaving an opening of not more than from ten to twelve square feet, as a passage through which to ventilate the whole mine. This passage, for the purposes for which it is intended, is entirely inadequate, and at the same time the checks the current receives in its passage are so numerous in its ascent through these obstacles that its volume and velocity are greatly reduced. In the ascent the ladders are changed at every length of from ten to twelve feet, thus placing at every platform an obstruction against which the current strikes and which impedes its movement.

The Broad Top mines are also worthy of mention as part of this system. As a general rule they are very poorly ventilated. Rockhill iron and coal company's mine is a new work, but promises in a short time to be as bad in this respect as any in the region. This company proposes to do a large business, but the statement of the condition of their work will prove to the initiated to what extent those intentions will be carried out. Their main air courses are from three to four feet wide by about one foot eight inches high, with only one place in No. 1 drift in which the smallest possible air current was observable. In the remainder of the work, the air was dead and stagnant, with powder smoke standing thick and very oppressive. It is true that in No. 2 drift a current was found of 135 feet per minute in the main air course by the furnace, where the passage is two feet six inches wide, by one foot eight inches high. But yet, wherever men were at work, the air was stagnant, and powder smoke stood in abundance. Rickerts' Bros. get their ventilation from Fisher's works adjoining. To use the expression of the boss of this colliery, "the headings get their air as best they can, wherever they can find it." We examined fully one heading, and the boss

informed us that it was a fair specimen of the others. Found it badly drained and the ventilation extremely bad.

R. B. Wigden's mines, at Six Mile Run, Bedford county, worked with a shaft. It has an air shaft forty feet deep for ventilation which is covered on the top and quite closely packed with ashes, excepting a hole in the middle just large enough to admit the passage of a man's body which is fitted with a door. When this door is closed no current great or small is possible. It can easily be seen what the character of this mine will be when working. The Snow Shoe mines, in Centre county, is another instance of the most primitive working of mines to be met with at the present day. This vein dips, and on the dip side of the heading, a seam is cut in the bottom of the coal to a depth of two and a half to three feet high which is intended to ventilate the workings. This of course proved an entire failure as not the smallest current was to be found in the mine.

The block system comes next under our notice. This system may do very well after the blocks are cut and the current provided. But while they are being cut, the miners doing the work, do it under peculiar difficulties. The blocks vary in size from one hundred and fifty to five hundred yards one way, and from one hundred to three hundred yards the other way. Thus the workman has to cut this long distance then turn at right angles and cut the other side from one to three hundred yards before there is any chance for a circulating current. These places are generally worked by two men shut up in this long narrow burrow, usually about seven by five feet, with a wall of powder smoke behind them, generally so thick that a light at a few feet distance looks like a small spark, which, with the carbonic acid gas thrown off by the men working and by the combustion of their lamps, produce a place than which any more injurious to health is hardly to be conceived. This system prevails largely in the counties of Tioga, Westmoreland, Washington, Allegheny and a part of Fayette lying near the Monongahela river; indeed as far as it can be said of any except no system, this system prevails quite generally throughout the bituminous region.

We should mention here as an exception to the general rule a portion of the work of the Morris Run companies' mines in Tioga, particularly their new drift in which they have driven a double main heading, the two being parallel and a few yards apart, with regulators applied to the several cross-headings at their junction with the main incast; thus giving to each cross-heading its proportionate share of pure current entering the mine fresh from the outside and returning it by an overthrow to the outcast. By which arrangement the expense of trap doors and trapper's wages on the main traveling ways is saved, amounting as is estimated in this case to near one thousand dollars per year, beside the advantage of each cross-heading getting its proportionate share of air current fresh from the outside which after diluting and taking up the gases and other impurities generated in that portion of the mine through which it passes is returned to the outcast without visiting and vitiating the air in any other portion of the mine.

This overthrow system is deserving the attention of all mining superintendents, and in conjunction with the success of this Morris Run experiment, may be quoted as strong coroborative evidence of the superiority of the double heading system over all others. The Loydsville mines, at the terminus of the Bell's Gap railroad, in Cambria county. This is an example of the *practical* workings of the block system. The mines look well on the map, the blocks looking very orderly and symmetrical. But in its practical application it is a failure in every sense of the word. In several of the headings where a number of the men were at work we found the miners in

the dark because they could not keep their lamps burning. In trying to reach them with our lights we found ourselves time and again compelled to call on others for lights for our lamps. The furnace is built like the furnace for an engine, with doors which when closed force the current of air to go under and through the bars reducing the volume of air that can pass to a minimum. Taken as a whole, this mine was as fair a specimen of want of intelligence in the management of a mine as it has ever been our fortune to meet. The Kittaning coal companies, tunnel colliery, is another specimen of this lack of knowledge and forethought. In its internal arrangements the headings are driven without any provision for ventilation, the circulation is everywhere dead and stagnant, not the smallest current being observable near where the men were working. On nearing the furnace which is placed near the month of the drift a small current could be discerned, heavily loaded with carbonic acid gas coming from the interior of an old worked out mine. Although this mine had not been in operation for some days previous to our visit still carbonic acid gas was found quite abundantly all around the working places.

Keeling's lower works, Allegheny county, is another specimen of this system. A tunnel is driven through the hill, through which a locomotive engine runs, bringing the coal from the second hill, and also from a heading driven back nearly parallel to the tunnel. These two are connected in several places, by cross headings driven through from one to the other, and through these cross headings the smoke from the locomotive engine is forced, (at every passage of the same along the tunnel,) driving it into the working places, and through lack of system in ventilation, allowing it to remain there, until by decomposition it becomes carbonic oxide, the most insidious foe the miner has to fear while following his avocation, for although it may be present in considerable quantities, the lights will continue to burn, and the unobservant will not notice anything wrong, until seized by giddiness, when if not removed to purer atmosphere at once, death certainly follows, while even if removed in time, there will be many days of sickness and even weeks before he can return to work.

The double heading system, has not as yet been given any general application. It is found in a few mines in the counties of Washington, Westmoreland, Fayette and Allegheny, beside the instance already noted in the Morris Run coal companies mines, in Tioga. One may occasionally be found in other counties, but as yet it can in no sense be said to have become general. In some instances superintendents drive double *main* headings only, while their cross headings are single, and driven often hundreds of yards apart, with no connection between them for circulation; in this plan little or nothing is gained, as the great desideratum in ventilation is the procurement of a sufficient current constant and reliable, and so distributed by circulation, as to furnish fresh air to every part of the workings, with as little cost as possible. This, the double heading system, if properly planned and persistently carried out, will furnish, as the following plan will show.

Linn, Wood & Co.'s new mines, at Pine Run, Allegheny county, is driven on this system and when completed by the application of the furnace which the company are about adding at an early day will supply a fair illustration of its value, this stands alone in this regard in Allegheny county. The Cliff mines, Washington county, are also worked on this system, and having a good sized furnace attached a strong return current was found. But as if to prove the necessity of constant care and attention in working on any system, all this advantage was lost by neglecting the doors and stoppings through the works by means of which neglect the distribution by circulation is lost through leakage. So much, so indeed.

that no current was found in the workings sufficient to move the anemometor, while the current entering the first cross-heading is conducted from one to the other until it makes the whole circuit of the mine, and before it completes one-half its journey becomes heavily charged with the black damp. All this, in this case, could be cured with proper attention to details at very trifling expense and make this mine stand a favorable comparison with any in the bituminous region.

The Coal Bluff mine, adjoining the above, is worked on this system, which being thoroughly carried out, and with sufficient furnace power attached, is a complete success. In point of excellence of condition alike for ventilation and drainage this mine stands out in bold relief at the head of all the mines visited by the commission.

The particular descriptions given here are those of the most noticeable case in which management is defective or otherwise either in the system or no system adopted or in carelessness, ignorance or indifference in carrying them out. While a glance over our notes of examination will serve to show to how great an extent the defects or excellences in management may be regarded as general or exceptional, we regard these descriptive remarks as sufficient to guide to correct conclusions in seeking a solution of the question, is legislation needed to secure to a reasonable extent the health and safety, physically and morally, of those who are called to work in our mines.

Upon a careful consideration of the whole subject, in the light of the facts set forth in our notes, which are the result of our examination we are impelled to answer this question affirmatively.

We might, possibly we ought, to reason out the question at length, quoting at length the authority of scientific men upon the character and effects of gases generated in mines. As this commission, however, was by the terms of the act creating it called upon to report the results of an examination more practical than scientific, as the existence of deleterious gases in coal formations has been determined conclusively by the researches and published conclusions of scientific men, until those publications have become text-books open to all whose interests or inclination lead them to inquire into the subject at all, and as such an extension of our report would only be an attempt to place before the Legislature facts in physical science that have been already placed before the public much more authoritatively by those whose education and pursuits have better qualified them for that service; we are impelled to the conclusion that our proper province is, after inquiry, to report whether in the mining operations of our State, the lessons of science and experience are so profited by and observed in the management of mines as to show proper regard for human life and health or whether neglect in this regard makes legislation necessary to secure it? We have already said that our investigation has led us to the conclusion that legislation is necessary and will only present a few more facts supporting our conclusion. The difficulty in the way of safely successful mining is indicated by the facts we have gathered and our observations to grow out of as sort of ignorant empiricism that would lead to failure and loss if practiced in any other pursuit; and this empiricism could not by any possible chance find employment or place, except in a system that regards the cheapness of the product of to-day, as of more consequence than health, safety and ultimate permanent profit. Among the results, besides those indicated in our previous remarks, may be cited the following as showing the extreme carelessness that naturally grows from it as to safety and comfort of operatives in the performance of their labors. For instance. In the shaft to be met with in the Bituminous Coal Fields great numbers of

them are very defective in the means of escapement provided in the event of accident where second shafts are provided for that purpose, they are generally used for pumping shafts also, the steam led down by pipes with the obstruction of their accompanying supports and machinery with rude and unsafe ladders for the men to climb or descend. In some instances the furnace, boilers, &c., are placed at the bottom through the heat and smother from which workmen must ascend and descend, while in some other instances safe and convenient ladders or stairs have been provided with landings at safe and convenient distances. Others again, as the Bethel company, in Mercer, have a slope for each of their shafts by which the men can enter and leave the mines. Philips & Co., Neshannock, the Oakland company, Westerman & Co., all of Mercer county, have good safe stairs provided for ascending and descending. The Bennington shaft, in Blair county, have a good slope for ingress and egress. While the Millwood shaft, Westmoreland county, which is 203 feet deep and which when in full operation works a large number of men, has only one opening which leaves no possible way of escape in case of accident at the shaft, an event that may occur at any moment.

R. B. Wigden's shaft, at Fair Play, Bedford county, has a second shaft forty feet deep, with no means of getting out or in through it, and altogether in an unsafe condition from loose strata. The Yough National coal company's shaft, eighty feet deep, near the village of West Newton, is sunk close to the Youghiogheny river, in Westmoreland county. This mine is worked extensively. It has a second shaft which has landers fastened perpendicularly one above the other, without any landings between the bottom and the top, no place to rest in the ascent, and the young, the old, the strong and the infirm, having once started must continue to climb until the top is reached. Should anything occur to excite alarm in the mine, the weak and old would have small chance of escape, and that such an event may occur is only too apparent. On examining the condition of the mine we found the works extended right under the river, without any precautions being taken to secure the overlying strata. Rooms have been driven under the stream of more than ordinary width, with pillars between them of only a few feet in thickness, in some places not more than from two to three feet, with what is known as a soot vein extending for a distance of about sixty feet under the river, which is equal to an open cut in the rock overlying. Taken as a whole a place more dangerous it would be hard to find, or one more likely at any moment to end in the destruction of the lives of all engaged in it.

We would look upon it as a work of supererogation to consume space in urging the necessity of ventilation, that being agreed upon. As what constitutes ventilation and the amount needed, are the only questions at issue, we will present a few observations upon, first, natural, and second, artificial ventilation.

NATURAL VENTILATION.

The ventilation of bituminous coal mines in our State may be divided into these two classes. Natural ventilation is the system upon which probably two-thirds of the mines visited by the commissioners are attempted to be ventilated. Under certain conditions and at certain times this may produce the desired object, but as a general proposition in nine cases out of ten it means no reliable ventilation. It seemed to be the belief of a great many mine superintendents and mining bosses that all that was necessary to secure ventilation was to have a number of openings to the mine, and that that secured ventilation. There-

fore, in ninety out of one hundred of the mines we visited, they said we had got to them the worst day they had had for a long time, and were sorry we had not come some other day. It may not, therefore, be out of place here to explain why natural ventilation in our bituminous mines is in so many cases a failure. The earth is surrounded by and inclosed in an atmosphere many miles in depth, so that the surface is the bottom of a deep sea or ocean of air. This air and all the gases, have, like all other matter, one physical property, which is called impenetrability. Therefore, if any space is occupied by air, no other physical body can occupy the same space at the same time. It must first displace the air. Because no two physical bodies can occupy the same space at the same time. Air, the gases and all other physical bodies are said to be inert, and will remain at rest or in motion until acted upon by some sufficient force. Owing to this property of inertia, a body will remain in that condition so long as the forces are equal on all sides. This is the state of the atmosphere in a calm. This equal pressure or force arises from the mere weight of the superincumbent mass of air and amounts generally to 14.7 pounds to the square inch at the earth's surface or nearly so. Lighten the pressure on the one side, and the ordinary pressure of the atmosphere drives the air toward the side where the pressure is reduced and gives rise to a circulating current of air. Reduce the pressure on any side and the air is driven in that direction, making a wind, the velocity of which is proportionate to the difference in the pressure on the two sides. Now, since the very great majority of our bituminous mines are drift openings, we will deal with them first.

These drifts are driven in from the side of a hill or ravine, and a very large percentage are driven clear through the hill, so that the difference in the elevation of the two outlets is very trifling, often not more than a few feet, and in many instances the mining bosses did not think there was any difference at all. The pressure of the atmospheric column at the two openings were therefore balanced, and the mines completely shut off from the smallest atmospheric current, and all the impurities generated in the mines and thrown off by men and animals and the combustion of the lamps, are effectually closed in upon the workmen. In those mines where the difference of the outlets in elevation is only a few feet a small sluggish current will move toward the lightest side, but its movement being slow every concussion it meets with in its progress impedes its motion and lessens its force. Every turn and every angle creates friction greater or less and reduces its velocity, while reaching a narrow place in the air course still more opposing the resistance of friction the current will become so weak as to be scarcely noticeable. As a cleanser of the mine it is utterly useless and powerless. Carbonic acid gas is more than one and a half times heavier than atmospheric air, hence this sluggish current is lacking in force sufficient to sweep the heavier gases before it to the outlet. Hopton says in his treatise on mine ventilation : "The heavier gases will always settle down through atmospheric air like mud through water." Another difficulty often stands in the way of natural ventilation. Should a swamp or dip in the measures be reached where the vein dips a few feet and rises again, the current will be checked in proportion to the depth the vein has dipped and on dipping below the depth of the opening the current will be stopped entirely. The hollow filling up entirely with air and closing its egress therefrom in the same manner as water would under the circumstances as demonstrated by J. J. Atkinson, Government Inspector of Mines, for the county of Durham, England.

Again, the wind blowing from a certain direction may blow into one of the inlets of the mine, and in consequence of the force behind be driven

through and find an outlet at a more sheltered opening, and often a swirl of wind may catch the late sheltered outlet and drive the air back toward the place it entered, to be again met by with a similar change of wind, thus keeping the current ever changing, as numerous instances could be given to prove if necessary. A few will suffice. Stones' mines, near M'Keesport, and Joseph Walton's, near West Elizabeth, are cases in point. The members of the commission sat at or near the outlet in the last named mine for a considerable time, and the current did not in all that time blow in one direction any one consecutive minute. Indeed, not long enough to enable them to measure its velocity. Now, it would flow in, then in a few seconds stop altogether, then flow out after a few seconds, thus changing its direction continuously.

Again, at Turtle creek, on the Pennsylvania railroad, when about to enter the mine, No. 4, belonging to the New York and Cleveland gas coal company, the wind blew almost a hurricane accompanied with rain ; the storm crossed the ravine and dashed into the inlet of the mine, giving upon our entrance a very strong current of air through the workings, but before we had gone more than round the works a very considerable diminution of the current was observable, and upon nearing the mouth to leave the mine not enough remained to move the anemometer. Outside, the storm had passed over and the wind had almost ceased to blow. These will suffice to illustrate the unreliability of natural ventilation and the reasons for it.

ARTIFICIAL VENTILATION.

The reasons we have urged here as to the inefficiency and unreliability of natural ventilation, bring us to the consideration of the means to be employed to supply the deficiency. In addition to the evidence of the facts we have mentioned as showing the necessity of ventilation, the accumulation of noxious gases exuding *not only from the coal* but from the breathing of men and animals in the low and contracted openings of the mines ; the decomposition of vegetable and other matter, and the product of combustion of powder, lamps, &c.; the reflection of those who have observed the effect upon the air, even in large halls when crowded, and the necessity for artificial ventilation there, will enable them to understand without much argument the absolute necessity of securing beyond the contingencies of high or low winds, or of the direction in which the wind may blow, current or flow of air sufficient to neutralize the contamination from those causes in the low and narrow chambers where men are (not seated for two or three hours leisurely enjoying the sermon, the lecture or the drama,) but where they must spend the working hours of day after day, sedulously engaged in strong manual exertion to earn the means of livelihood, in passages seldom exceeding five to seven feet in height and from seven to thirty feet in width. These means are sought to be procured through artificial ventilation, and the discovery of the best appliances for procuring it has been for many years the study of the best practical minds interested in mining. The appliances that have been devised have varied in character greatly, and naturally the partisans of each and every plan have felt and expressed the strongest confidence in the superiority each of his own specialty. Experience, however, is gradually throwing more and more specific light upon the subject, and it may be regarded now as a fixed fact that whatever strength of current may be required to secure pure air in sufficient quantities and steady supply can be furnished by human ingenuity inspired by a will to accomplish the end. The means used have been and are various, as the furnace, the suction fan, the steam jet, the water fall, &c.

Warrington Smyth, M. A. F. R. S., &c., Chief Inspector of the Mines of the Crown and of the Duchy of Cornwall, England, says: "In selecting our ventilating power it must be remembered that the great object to be attained is a large volume of air at moderate velocity, and that on this account most of the simple fans and certain other classes of machines which have to force the air through insufficient valve room give it an unnecessary velocity which in other words means an increased resistance or proportionately diminished ventilation, while the enormous volume of air actually circulating by means of the furnace its facility and the certainty of its action have obtained for it a decided preference in England particularly in deep mines." During our tour one fan only was met with, erected at the Penn gas coal company's shaft, near Irwin station, on the Pennsylvania railroad. This is a ten feet fan, and for the work to which it was applied produced a weak and ineffectual current. Mr. Smyth (above quoted) says, "It needs no argument to impress on those who know the necessity of ventilation in our public halls and churches, and in our private rooms, that it is in a high degree essential to take thought for the replacement of vitiated, by fresh air, in the low and complicated chambers of coal mines, where many men and animals are at work, and where numerous lights, with powder smoke and dust, are contaminating the atmosphere, and consequently contaminating and poisoning the blood, sowing seeds of disease that bear fruit in a premature decrepitude or the grave."

It is highly probable that furnace power is most suitable generally for the ventilation of our bituminous coal mines, owing to its being more economical in the drift openings. But in order to make the furnace or any other appliance available for the object in view, whatever is used must be provided with an intelligent comprehension of the work it has to do. The application of a fan that would be sufficient to blow the fire of an ordinary engine for a flouring mill to the work of ventilating a mine will always prove practically a failure. The same remark will pertinently apply to the greater portion of the furnaces in use for the same purpose, and argues alike in their power and the usual method of their application, and ignorance of the sufficiency of means to ends that savors much of the primitive operations Mr. Smyth alludes to in the following extract: "In early days it was usual to build a stack over the pit mouth, and at the surface attach a furnace accessable from the top through doors, or hang a fire lamp or basket in it to create a current." Indeed this plan, primitive as it is, is found in some of our mines to-day, with low stacks only a few feet high. As the velocity of the ventilating current will be in exact proportion to the height of the column of air heated, so a stack of ten or twelve feet high will not give more than one fourth or one fifth the current a stack of fifty or sixty feet would give, although the same furnace power were used in each. The only difference being in the amount of coal used, which would be in proportion to the greater amount of air set in motion, and would amount to four or five times as much in the high as in the low stack. So, if one foot of air expands to two feet by heating the two feet will only weigh as much as the one foot did before heating, and consequently the column in the twelve feet stack would only weigh as much as six feet, while the column in the sixty feet stack would weigh the same as the thirty feet which gives the high stack a preponderating power equal to the difference in the height of the stacks or sixty feet in weight of displacement. Producing the great difference in the ventilating current as fourfold pressure only gives a double quantity and a ninefold pressure only gives a treble quantity. Thus the air in the shaft is heated and expanded. It become lighter, bulk for bulk, than the cool air in the other opening and no longer balances it.

The pressure of the heavier air then overcomes the lighter and pushes it upon the shaft before it to be in turn heated by also passing over the furnace. Thus a continual current of cool air is passing in at one opening and out at the other heated. In using the current thus created for the purposes of ventilation in mines the air instead of being allowed to pass directly through the passage from one opening to the other ought to be guided by means of stoppings, doors, overthrows, &c., into and along the various passages of the workings of the mine and in proportion to its force or velocity as it sweeps through these workings, will it purify and carry off the gases as they are given off. This *distribution* constitutes the ventilation of the mine. Where furnaces are used to create the current the deeper the upcast shaft the better, because this gives use to a longer column of upright air to be heated, and so a greater circulating pressure and consequently a brisker ventilation is secured. The sluggish current in shallow shafts and low stacks is owing in general terms to the slight difference in the elevation of the incast and the outcast and the shortness and consequent weakness of the force produced by the column of air to be heated. With regard to force or velocity required for ventilation we may here profitably and properly quote Mr. Atkinson again. He says: "A difference of only one pound to the square foot in the weight of the air two different points will give rise to a wind in the open air of a velocity 28.8 feet per second or more than nineteen miles per hour which is nearly equal to the highest velocity of the air in the upcast shaft of a mine. In practice, in the ventilation of mines, it is found to be necessary to employ a very much higher pressure than that in order to give rise to this velocity. Indeed it is found necessary to employ as much as from ten to twenty pounds per square foot less or more in proportion to the amount of friction to be overcome arising from the air pressing or rubbing upon the top and sides of the air courses. This friction is really the greatest obstacle to be overcome by the ventilating power. The force required to put the air in motion apart from the friction being very small comparatively particularly in coal mines, which generally require a much more energetic ventilation than is necessary in metallic mines." The same author then gives the results of tests in a few English mines as to the amount of pressure required to overcome the frictional resistance. "In Hetton Colliery, out of a total pressure of nineteen pounds to the square foot of force, eighteen pounds were expanded in overcoming the frictional resistance, leaving only one for velocity. At Haswell colliery ten out of eleven, leaving only one for velocity. At Tyne main colliery seven out of eight were again spent on frictional resistance and only one on velocity." From these examples it will be perceived how great is the importance of understanding the general laws and principles upon which the friction of air depends, especially to those charged with the responsible management of mines, so that they may know how to reduce it to its lowest possible amount and thus obtain the greatest results in ventilating force from any appliance they may adopt for that purpose.

As the difficulties in the way of securing proper ventilation are so great, and of those who are engaged in the management of mines so few are sufficiently informed, or manifest a disposition to become so, to overcome those difficulties, it may become a pertinent question whether all this insisting upon effective ventilation, is not an attempt to load the business of mining with onerous, vexatious and unnecessary expenses and requirements. We, therefore, in the performance of our duty deem it proper to submit a few observations on the

This necessity has been fully recognized by intelligent and Catholic-minded mining operators and engineers for a long time in those countries in which mining is an old as well as important pursuit, and as we have before remarked the means of supplying it have been the subject of careful study and scientific inquiry for many years.

W. W. Smyth, inspector, &c., before quoted, in speaking of ventilation, says: "For the ventilation of a mine it is, therefore, not sufficient to supply air enough for the breathing of men and animals and the burning of lights, but we must provide for the sweeping away of the products of breathing and combustion; for the removal of the gaseous results of blasting, and of the decomposition of vegetable and animal matter; for cooling of the excavations where the temperature is high, partly from depth and partly from chemical changes, and, lastly for the dilution of the gases exuding from the coal. In round numbers one hundred cubic feet of air per minute may be required for the health and comfort of each person underground. But if fire damp be given off and the rate of about two hundred cubic feet per minute we should need at the very least thirty times that amount of fresh air to dilute it. Increase the number of men and liability to gas, and a greater proportionate amount of pure air may be indispensable for safety." The gases most commonly met with in the bituminous mines of this State, are carbonic acid gas, given off from men and animals, and from combustion, &c. Carburetted hydrogen, exuding from the strata. Carbonic oxide, the result of the explosion of powder, combustion of wood, coal, &c. Sulphurated hydrogen; this gas is frequently found in old unventilated workings, where water accumulates and lies, and is probably produced by the process of the decomposition of pyrites of iron in mines."

J. J. Atkinson, says: "Carbonic oxide gas has a much more deleterious effect on the animal economy than carbonic acid gas; air which contains only one per cent. of carbonic oxide gas almost immediately causes the death of warm blooded animals, as has been shown by decisive experiments of Mr. Felix Leblanc. When inhaled it produces giddiness and fainting fits." This gas, he further adds, "is perhaps never found in coal mines, except as the result of the explosion of gun powder, or the combustion of coal or wood. It is itself inflammable, but supports combustion of other bodies. Candles or lamps would burn in this gas when life would become extinct, and it is probable that many deaths in mines (otherwise unaccountable) have resulted from this gas, while the lights have continued to burn. It appears to be very probable that the deaths of the men and boys in the Hartley colliery accident in England arose from this gas given off by the furnace, after the stoppage of the air current by the closing of the shaft, inasmuch as the lights used by the workmen engaged in clearing the shaft appeared to be rather increased in brilliancy than otherwise at the time when the worst effects were felt from the escaping gas. The mine gave off no fire damp, and very little choke or after damp."

Mr. Atkinson further adds, "the explosion of gun powder gives rise to carbonic acid, nitrogen, carbonic oxide gases and steam, besides carburetted and sulphurated hydrogen in small proportions. In the ordinary course of mining these causes give rise to so small a quantity of gas in proportion to the air, that unless in a confined and unventilated part of the mine where a shot has been fired, or in the more rare case where the coal is on fire, are they to be feared as dangerous to life."

These gases are all capable of causing the death of men, and animals breathing them in their undiluted state, and of course are injurious to health

when partially, but not sufficiently diluted; and require to be mixed with many times their own volume of air, before the mixture they form with it, can be breathed for any length of time with safety.

The grand object of the ventilation of mines is to cause such a current of air to constantly circulate through them, as shall by mixing with and diluting the gases, render them harmless, and by its movement carry them off as rapidly as they are produced in the mines. A weak sluggish current is of small benefit under these circumstances, in mine ventilation, as several of the gases generated in mines, as we have already shown, are heavier than atmospheric air. The latter if weak in movement, drags its way slowly along the tops of the air-ways and headings (while the heaver gases through their greater density, gradually settle down upon the floors of the passages, and are left there) and visits all the working places, overheated, clogged with dust and smoke, and laden with the impurities it gathers on its way. In the incasts there is often found a strong current blowing into the mine, while in the interior, where the working places are, and men are working, scarcely any movement can be found, the current being lost in its course by leakage in doors and stoppings, leakage, caused by neglect, and inattention to repairs, or by ignorant and faulty construction. In the race of competition, how little attention is given to the science of ventilation in our bituminous mines, will be apparent to any one reading this report and the accompanying notes of examination. Numbers of the mines have their headings driven double, and the mines well laid out in every particular, and yet have no ventilating current, owing to the neglect in providing furnace or other ventilating power entirely, or to their being so ridiculously inadequate to the work they are provided to do, that they might as well be without any. Or air courses filled with *debris*, or the air courses cut so small as to be utterly inadequate, some of them as will be seen by our notes, being the merest holes, not more than large enough to let a man through, one that was found being said by the owner to be about large enough to pass a man's head through, while another was found where the road was laid for five or six hundred yards in an entry not more than three feet high, which was also the main air-course. Again, many air-courses are driven full-heading size for a distance, and then from motives of false economy drawn in to half or less than half the size, while some again are only large enough to look through; places a man would find it impossible to crawl through, yet are considered sufficiently large to ventilate a heading where twenty and often more men are at work. Carburetted hydrogen gas is found in a number of the mines in the counties of Westmoreland, Allegheny, and a few in Washington, and it occasionally makes itself felt by pouncing upon some unweary individual, as reports of occasional wastings fully verify. Smyth says, the presence of carbonic acid gas greatly reduces its explosive qualities, when there is as much as one-fourth of this gas present, it burns without explosion, and a slightly increased proportion will cause suffocation. Thus, it would appear to be possible or even probable that the poor condition of ventilation that prevails, may be the principal cause of the carburetted hydrogen not being more frequently exhibited in quanities to attract attention; this gas has only been seen in a few instances since the mines have gone deeper into the hills.

Physiology, supported by all experience, teaches us that the blood can contribute to health and growth only as it exists in a pure and healthy condition. If then the condition of the blood affects all the functions of the body, (as it certainly does,) and if (as is equally certain) the atmospheric air which surrounds us, and which we are constantly inhaling, is the great purifier and regenerator of the blood, then this must follow, viz: That

nothing is or can be more essential to health and life than a wholesome atmosphere. The atmosphere, as the authorities we have cited prove, may be so vitiated as to be absolutely fatal to life. This being the case, a degree of vitiation, varying not in kind, but in extent, will certainly be detrimental to the health of those who breathe it.

In the case of a healthy young or middle aged man, the quantity of air exchanged in the lungs at each ordinary tranquil breath, is from twenty to twenty-five cubic inches, and each individual draws his breath, upon an average, eighteen times in the minute. At each respiration a pint of air is taken into the lungs, and when the person is engaged in active or laborious occupation, the number of respirations and the volume of each will be largely increased. In taking a very full deep breath, we may completely fill the lungs, but in respiration, we cannot possibly entirely empty them. What we give back, is said to be one-fifth of what we retain. Now, as one function of the blood is to gather the excess of carbon evolved in the body by the vital combustion, and bring it to the lungs to be carried away by respiration in exchange for the oxygen required to replace it, it must be plain that if an atmosphere is breathed that is already over charged with the carbon it is its function to carry from the lungs, that to just that extent the air breathed fails in the execution of its function, and life is destroyed or weakened just to the degree to which the deleterious operation is full or partial.

To show that in the operations of mining, those who are engaged as workmen are peculiarly liable to the dangers and evils here spoken of, the whole drift of our report, sustained by our notes, proves. And this evil is not the result of willful, deliberate, purposed wrong; but the outgrowth of that peculiarity in human nature, through which it is so much easier to believe that to be true which appears to comport most to our apparent immediate interest.

As a general rule ventilation appears to be more particularly neglected where it is most needed. That is, where the men are at work.

In a very large percentage of the mines we examined we found no current observable in those parts of the mines where the large body of men were at work. The general excuse is, "in the winter we have too much;" or, "the wind to-day is coming from the wrong direction;" or, "when the cars are running we have plenty of air." The unsoundness of the last plea we will try to make plain; with the others we have dealt under the head of natural ventilation.

Let us suppose the air in the interior of a mine motionless and at rest. It will remain in that state until some force or pressure is brought to bear upon it sufficiently strong to set it in motion. In this instance the only force brought to bear is produced by the motion of the cars along the traveling ways. A mule is hitched to a trip of either empty or loaded cars and they are set in motion and come in contact with the stagnant air in the traveling ways forcing it along before them, and at every opening the air is driven around the pillars with a force proportionate to the rate of speed at which the cars are being driven. The air thus forced around the pillars falls in again behind the train as it passes and speedily its usual tranquility is resumed to be again displaced by the returning cars and sent eddying about to again settle down when the disturbing cause has been removed. This is no current to carry off noxious gases and remove them from the mine it is only temporary displacement. Like as a boat forced along the smooth surface of a stagnant lake causes a displacement of the water which is forced off at either side, and after the boat has passed gradually takes its smooth surface again. No one looking on would for a moment

suppose he had seen a fresh stream of water rushing across the lake and taking its rise only from the prow of the boat. No more is it a current of fresh air that is produced by the motion of the cars in the mine. It undoubtedly may be of some benefit under certain exceptional conditions and for a certain length of time; as, if the air at some distance behind is fresh and purer than that when the men were at work, the force with which the current is driven around the pillars carries the gases produced by the miners and by combustion of the lights, &c., with it and the purer air behind rushes in to fill the void. At the same time it must be observed that the return trip will drive back the vitiated air and at least to some extent restore the *statu quo*; so the operation will be repeated until the purer air behind is impregnated with the foul gases present until all becomes of equal foulness, and then it will act exactly as a pool recking with filth would in a crowded alley in a great city carrying disease and death to all compelled to inhale it.

A great number of mines in the Pittsburg region give off more or less explosive gases, more particularly on the Monongahela river. Explosions more or less damaging to life and property have occurred within the last few years. At Irwin station, on the Pennsylvania railroad, a great deal of gas is given off in some of the mines, and only a short time before our visit, a serious explosion occurred in the Penn Gas coal company's shaft in which two lives were sacrificed.

Another source of danger is in falls of roof and coal yearly causing great numbers of accidents which with proper care on the part of the workmen and attention on the part of the operators might be avoided.

As the supply of prop wood is generally left on top and all lengths piled together, the miner on going out at night, requiring props for his safety the next day, must go to the pile, select his props often cut all lengths and to be re-cut by him, and carry them to the shaft or pit mouth to be sent into him next morning; as his clothing is often wet with perspiration through working in the high temperature of the mine, and always damp with the mine moisture, the sudden change from a warm to a cold temperature will often tempt him to take the risk of danger in the mine from insecure propping rather than suffer the cold in his wet condition in securing his props. This leads to many accidents. The temptation is a very strong one to avoid the necessity of working about in the open air, with imminent danger of taking cold, beside the extremely chilling sensation of wet clothes freezing on him, together with the danger sometimes of losing his turn by not having his wagon loaded when the driver comes round, frequently leads to his taking risks in working without props, that end in his death from falls of slate or in his being crippled for life. It would seem that the equities would require that these props should be cut in proper lengths, ready for the miners' use, and placed in the mines within his easy reach. These remarks do not apply to mines on the Monongahela river, it being the custom there to furnish the props to the miner in the mines.

Another source of danger is in the traveling ways in numbers of mines. The entrys or headings are driven without timbering, and in course of time by the action of the atmosphere and gases in the strata, the top works and shells off in some places to great height, sometimes eight and ten feet above the top of the veins. In shelling off, it gradually narrows toward the top, until it assumes a cone shape, seven or eight feet in width at the top of the coal, and narrowing up as it rises into the overlying strata until in some places it comes to a point. The heavy benches on the sides and high over head are liable to fall and crush those passing along at the time. They are very dangerous, and could and should by proper timbering in time be

secured. At one of the mines at Penn station, on the Pennsylvania railroad, a few months before our visit, two persons were seriously injured, one of whom died a few days after, through the effects of the injuries received by the fall of one of these benches, which slipped off the side many yards long, several feet in thickness and five or six feet high.

Another danger awaiting in the near future and fast approaching is the holeing into old works. A great risk is incurred in approaching old abandoned workings, particularly shafts, from their being always filled up with water after their abandonment, and also foul air ever ready to escape under great pressure, and certain if incautiously tapped to cause disastrous inundation. This danger is greatly increased by the absence of proper plans of the old works. All over the State where shafts are necessary to reach the coal, numbers of these abandoned mines are to be met with, and no correct plans of them existing, while the adjoining coal land is being operated, with the liability at some time or other to tap the old works and let in the subterranean lake, to flood in a few minutes the new or operating work, without giving time for the escape of a single soul.

In shaft workings, another source of danger prevails, viz: Any person having to cross from one side of the works to the other, have generally to pass the bottom of the open shaft, under great liability, in a moment of thoughtlessness, of being caught and crushed by the descending cage, with its weight including that of the empty car of one and a half to two tons weight; and again, the cage resting on the bottom of the shaft, men and boys attempting to cross over on it, are liable to do so just at the moment the machinery on top is put in motion and the cage is snatched off, with great danger their attempting to escape of being caught between the cage and timbers and torn to pieces. All these risks might be easily removed by simply cutting a passage in the coal at the side large enough for a man to pass, which could be done in an hour or two by two men. Another source of danger to miners is in ascending and descending the shafts, through machinery being in an unsafe condition, with ineffective brakes, steam valves loaded down with old iron, &c., ropes too long in use, and run long after the day of their safe usefulness, as their external appearance indicates, with the links connecting the rope and the cage apparently made of not even three quarter inch iron. A few years since a bill passed the Legislature to the effect that in certain counties a certain condition of ventilation should be observed, that safety cages should be used in all shafts, with covers attached to protect the workmen in ascending and descending the shafts from any lose strata or other matter falling, also in winter time from the great quantities of ice formed in the shafts, which in fresh weather is loosened and falls down in large masses. These dangers still exist, notwithstanding the law, which has become a dead letter through lack of some to see to its enforcement, causing numerous accidents and leading to numerous narrow escapes.

The law was for a time observed, at least so far as to the safety cages, and in some instances slip gates, (which, when the cage was moving in the shaft, closed in the top of the shaft, and on the cage nearing the top caught the gate running it up before it out of the way, until such time as the cage was ready to descend, when the slip gate again returned to its place in the mouth of the shaft and closed it up.) These things were attended to for some time after the law went into effect, in nearly every shaft in Mercer county, owing probably as much to a serious accident that occurred in the Ormsby shaft, attended by the death of four men and serious injury to a fifth, as to the law This accident took place only a few weeks after the law was enacted. The facts were as follows: Five men took their places

upon the cage, in order to proceed to their work, on the morning of January --, 1870, the engineers drawing the stops in order to let the cage, with its living freight, descend, the rope broke a short distance above the cage, and it fell to the bottom, a distance of eighty to one hundred feet. Four of the men were found dead, or died in a few minutes, and one was horribly injured, but subsequently recovered. At the investigation which followed no one could say how long that rope had been in use. The mine boss had been there for a number of years, but could not remember its being brought there. The wires of the rope broke off like a rotten twig. The accident created great excitement, and safety cages and slip gates were the result. As, however, the accident gradually took its place as a thing of the past, these improvements also followed the same course, and were placed in the same list. First the gates when broken, would be laid aside for repairs that have not yet been begun. The springs of the safety catch, or some other part of the cage would get out of repair, but would not be attended to, and the broken springs hang jingling, like old cow bells, over head probably for the last two years; they have passed away with the other memories of the accident, to be again brought into use, it may be, by another similar tragedy, unless the Legislature restores them by legislation that cannot be evaded. This mining bill has become a dead letter. Although a good bill, so far as it goes, yet for want of some one on whom the duty of seeing it enforced is especially imposed, it has fell to the ground, and not the slightest attention is paid to it. Neither have proper means been provided for ingress and egress for workmen, at least in a majority of cases. The most primitive and unsafe means are generally constructed. A few have good stairways, or slopes, and if all had them it would become a matter of indifference to the workmen what condition the machinery and hoisting gear should be kept in. Safe manways are always to be preferred to any arrangement of machinery, provided they are separated from the powder smoke and poisonous gases given off in the mines.

The commission in closing this report, deem it due to themselves, to say that they have earnestly tried to divest themselves of all preconceived prejudices or dogmatic opinions, and reach conclusions based exclusively upon the facts as they have found them, by personal examination, or from credible information. We have earnestly desired that as both sides of the interests involved in the questions at issue are represented in the commission, that that best proof of impartial inquiry, and truthful statement that would possibly be given, should be presented here—viz: an agreement of all in the same report, not by compromising any truth for that purpose, but by striving to state it just as it is.

We may further remark, that all information contained in our notes of examination, as to the number of men and mules employed, the distances headings were driven, distances between headings, and distances headings were driven beyond the ventilating current, is derived from the pit bosses, or mining superintendents, and are therefore entitled to the credit of not being overstated, where they bear hard upon the management of the mines.

As a general rule the miners did not exhibit much alacrity in calling the attention of the commissioners to places specially noteworthy, but inclined almost entirely to avoid giving information. He had therefore to depend exclusively upon the good will and frankness of the owners and their agents for such knowledge of the workings as would enable us in the short time it was possible to devote to any one colliery to make the examination. We were in nearly every instance treated with courtesy, and no disposition was manifested to obstruct us in the performance of our duty. At numbers of the mines visited they did not have any maps of their works, and at others

they were so small as to be useless, and finally we resorted to the plan of having the mining boss draw a rough sketch or plan of his mine before we entered it. In this way we obtained a general idea of how the mine was laid out.

In presenting the amount of air circulating in each heading and air way, with the number of men and animals, together with a light for each person employed in a mine, and also the number as they are generally placed for work, in the various headings, the real condition of the various parts of a mine is made plain to the most uninformed. The best mining engineers agree in the opinion that one hundred feet of pure air per minute is necessary for each individual employed in a mine to keep it in a healthy condition. It is therefore plain that in a pit where from fifty to one hundred or more persons are employed, and a number of animals beside, and where as is shown in a great number of instances no current at all, is perceptible, that mine cannot be in a healthy condition.

Drainage is a much more difficult subject to deal with, not because proper drainage is not of great importance, but because the possibilities of perfection in drainage depends so much more upon natural conditions than does ventilation.

The mines in the Shenango Valley are generally very hard to drain, owing to the irregular position in which the vein is found to lie. Rolling in hills and swamps often of considerable difference in elevation, and not unfrequently a hard sand stone bottom that makes drainage a very expensive operation, especially where a distant part of the vein has to be reached. Mines in regions of the bituminous coal field, which have the advantage of soft material underlying, can be kept drained at very little expense, while others again nearly drain themselves, so that it will become manifest that the indications furnished by our notes without this explanation might be misleading, by giving great credit for drainage to the management of a mine that costs nothing for that purpose, while another which costs largely would be looked upon as remiss in comparison, while it is really entitled to greater credit.

It may be well here to call the attention of your Honorable bodies to the message of the Governor of Ohio, inasmuch as we are about to signalize the conclusions we have reached by recommending the passage of a ventilation law, and the creation of a board of inspectors for our bituminous mines. The Governor says: "At your former session you performed an act of justice and mercy toward the men who delve in the mines, by enacting a law to regulate mines and mining, and to provide for a State inspector of mines. A practical miner of intelligence and education was appointed, who has displayed great energy in the enforcement of the act. He has personally inspected two-thirds of the mines in the State, and the good effects of the law are recognized already in the improvement of ventilation and other beneficial changes."

Wherever these inspection laws have been adopted and enforced decidedly beneficial results have followed. In the anthracite region of our State it would be difficult to find any one interested in mining who would be willing to see the law repealed and the system of inspection abandoned. The regular and constant diminution of accidents resulting in death or serious injury, the growing self respect of the workmen as a mass, inspired by the consciousness that the State ranks them as citizens whose interests and welfare are to be conserved equally with others; in fact, all influences growing out of it have shown its beneficence and value. As the facts, as we have been compelled to state them, show that the same necessities exist now in our bituminous mines as led to the adoption in the east of the inspection

system. We respectfully recommend to your honorable bodies the adoption of a law for the bituminous region having the same general object in view, but framed to suit the different conditions prevailing there, as those to which we have called attention suit the necessities of the regions to which they are applied.

All which is respectfully submitted,

AUGUSTUS STINNER,
JOHN O'NEIL,
JOHN ARCHIBALD,
Commissioners.

PITTSBURG, *February* 8, 1875.

Notes of the Commissioners, for examining the bituminous coal mines of the Commonwealth, appointed by the Governor in pursuance of joint resolution of the General Assembly, approved May 6, 1874.

July 21, 1874. Works of Lee & Patterson, on the Pittsburg and Erie railroad, near the line of Beaver county, in Lawrence county.

At the junction of the main air drift with the entry the velocity of the air current was found to be 210 feet to the minute, through an air course three feet five inches high by three feet six inches in width, showing a volume equal to 5,410 cubic feet of air per minute. In cross headings current not enough to run the anemometer, air close and standing powder smoke.

There were working in these mines 85 men and 10 mules. Found near the face of the entry standing powder smoke. Upon inquiry were informed that no accidents have happened in these mines. The mines are well drained; two outlets.

The Clinton coal company, same locality, adjoining. The main entry is driven about 1,200 yards. At the junction of the air course with the main entry the velosity of the air current was found not sufficient to move the anemometer, nor anywhere in the mine. Found the entries very muddy, with water standing in some places, air close. About 70 men employed and five mules. Upon inquiry found that no accidents had occurred, two outlets.

July 22. Works of Mansfield & Grim. Cannel coal. Beaver county. Main entry driven between 500 and 600 yards. Ventilation very poor, no perceptible current three hundred yards from the face of the main entry; not running at the time of examination. When in full operation employ from 40 to 50 men. Appeared to be sufficiently drained.

The Sterling coal company, Beaver county. Treeman Butts, manager. Main entry driven nearly one mile. Current of air barely perceptible, not enough to move the anemometer anywhere in the mine; air foul in nearly all the working places; water hoisted by a pump in the shaft, but the drains did not appear to carry the water to the pumps, as the entries were extraordinarily sloppy, so much so that men could not well walk the entries.

July 24.—Works of Bell & Pearson, near New Castle, Lawrence county. Main entry about 1,200 yards. Work appears to have been carried on without any system; very small air current, not sufficient to move anemometer; badly drained and poorly ventilated; in bad condition generally. Thirty-five hands and six mules employed. The entries generally very low, with men pushing loaded cars along a height of three feet. No accidents reported.

Miller's mines, same locality. Worked by shaft 32 feet deep; hoisting by horse power, which is very primitive and unsafe, men being taken up and down without brakes or any other provision for safety; did not enter the mine.

Simpson's shaft, near the above, and same description applies.

July 25.—Kimberly & Kerns, Sharon, Mercer county Main entry driven about 500 yards; air current 300 feet per minute through an aparture two feet eight inches square, showing 2,354 cubic feet of air per minute; twenty-five men and two mules employed. Head of entry, air a little slack, being driven past air course; drainage pretty good.

July 28. Pacific Slope, operated by Dersham, Sharon, Mercer county. Slope 265 feet in length, with a depression of one foot in three. Main entry driven about 225 yards; thirty miners and two mules employed; system of ventilation very defective, air conducted by wooden partition or brattice, nowhere could be found current enough to move anemometer; smoke and black damp standing all through mine; badly drained, water over boot top in some of the working places; in operation nine months; worked without any apparent system.

July 28. Files Old Shaft, Neshannock, Mercer county. These works have two openings, one a hoisting shaft 180 feet deep, the other a pumping shaft, with engine, boilers and furnace in bottom of shaft; both are used as upcasts, the incast being through works of John Phillips & Co., adjoining. Employ about 100 miners and 9 mules; the stables are close to bottom of shaft, and the exhalations emanating from them affect the air for a considerable distance around. At the point where the air issues from Phillips & Co.'s works it is strongly impregnated with black damp, and is conducted into the mine at its junction with the main entry; found current of 55 feet per minute, through aparture 4 feet 10 inches by 4 feet 7 inches, showing a volume of 2,068 feet per minute, and a short distance therefrom is weakened through leakage. M'Intosh heading, no current noticeable, air heavily loaded with black damp, in other parts of the mine found ventilation similar. In the Little heading, where nearly one-half of the miners are employed all operations had been suspended on account of foulness of the air; drainage imperfect.

Joseph Forkers & Co.'s shaft, Neshannock, Mercer county. Depth of shaft 120 feet. Second outlet for men by pumping shaft and air outcast. Main entry driven about 1,300 yards. Employs about 100 men and eight mules. Current of air at bottom of upcast 100 feet per minute, elsewhere did not find current enough to move the anemometer. The air course was five feet by six feet six inches, showing a volume of 4,521 feet of air per minute; so far as was examined no great vitiation of air was found. Drainage tolerably good. There appeared to be no definite system of ventilation observed.

July 29. Bethel coal company, shaft No. 1, Bethel, Mercer county. Depth of shaft 90 feet, two outlets. Workmen are not permitted to enter the mines by the hoisting shaft, there being a slope prepared for ascending and descending, well framed. Main entry driven about 900 yards. Employ 100 men and eight mules. Current of air not enough to move the anemometer anywhere within 300 yards of the face of working places; at this distance from the face the current was 96 feet per minute, maximum. Size of air course five feet three inches by three feet, showing a volume of 2,097 feet per minute. No apparent system of ventilation.

Bethel Coal Company, Shaft No. 2. Depth of shaft 54 feet—men not permitted to ascend or descend by hoisting shaft, slope provided for that purpose, well framed, dry and in good order. In main air-course at bottom of

upcast current of air was found to be 200 feet per minute through an apperture four feet two inches by two feet four inches, showing a volume of 2,275 feet of air per minute—found nowhere else current enough to move the anemometer. Drainage defective. Water at some points in the working places. Pit is hard to drain. Two Cambrian pumps are used. The mine standing idle; not worked for some weeks previous to visit; when working employs about 70 hands and three mules. Main entry driven about 190 yards.

Westerman, Buhl & Co., Homebank, Mercer County. Shaft 115 feet deep. Men are not allowed to go up and down the hoisting-shaft, a shaft being provided for that purpose, with stairs and platforms to insure safety. Main entry driven about 650 yards; employ about 85 men and six mules. Pit well drained; ventilation bad, not sufficient current found anywhere to move the anemometer; air hot and oppressive nearly all over mine.

July 30. Mercer Coal Company, Stoneborough, Mercer county. Main entry driven about one and a half miles; employ about 220 men and twelve mules; air-current was found to be in main air-course, at a mile and a quarter from the pit mouth, at the upcast, 210 feet per minute, through a passage five feet three inches by five feet, showing a volume of 6,397 per minute. The air line current is produced by a furnace 6 feet wide by $5\frac{1}{2}$ feet high and twelve feet long well constructed. Also, an air-course in No. 7 entry, current 85 feet per minute through an aperture four feet eight inches by four feet nine inches, showing a volume of 2,713 feet of air per minute. This latter current supplies 100 men and five to six mules before joining the general current at the upcast. Air is slack toward the head of the entries, heated and smokey and in the rooms. The mines are quite wet but are being rapidly improved under their present managemet, which has not had time to perfect its improvement in drainage and ventilation, both of which had been badly neglected.

July 31. Catfish Mines, Clarion county, Pittsburg coal and mining company. Pit No. 2. Main entry driven about 200 yards. Employ 75 men and 4 mules. Air current was found to be at the intake of main air course 240 feet per minute through an aparture 5 feet by 8 feet 3 inches, showing a volume of 11,253 feet per minute, which current flowed through the entries only; the rooms being driven in some instances 90 yards without break-throughs. One entry was found an exception, having no current and the air in which was oppressive. The drainage was good the mine being dry.

Pit No. 1. Distance main entry driven unknown. Sixteen men employed. Same report applies to this as to the former, the two mines being connected.

August 3. Stein & Sons, Camp Hill, Mansfield, Allegheny county. Main entry driven about 400 yards. One hundred and eighteen men and 4 mules employed. Current in main air course not sufficient to move the anemometer. No. 2 entry. Twenty men at work; and no current; air heated and oppressive. Considerable standing smoke. No. 3 entry. Twenty men at work. No current. No. 4 entry. Eighteen men at work. No current. No system of ventilation. Drainage fair.

August 4. Felix C. Negley, Mansfield, Allegheny county. Main entry driven 410 yards; employ from 80 to 100 men and seven mules; not working when examined. Not sufficient current found anywhere to move the anemometer; no system of ventilation, but air tolerably good; there are four or five outlets; drainage good.

Pittsburg Coal and Coke Company. Bell, operator, near Mansfield. Main entry driven about 1,130 yards; employ about 65 men and 12

mules. No. 2 entry, six men work; air current 80 feet per minute; aperture four feet four inches by six feet ten inches, showing a volume of 3,492 feet per minute. No. 3 entry, 25 men work; air current not enough to move the anemometer. No. 4 entry, hirty men work; air current not enough to move anemometer. To these works there are seven outlets; mine not in operation for some days previous to visit; drainage good.

August 5. Hite's Coal Mines, Hite s station, Allegheny county. Main entry driven about 700 yards; employ about 60 men and five mules; air current enters incast and passes directly through to outcast; no distribution; without system of ventilation; drainage good; not running at time of visit.

Vesuvius Coal Company. Chalfant & Lewis, operators. Hite's station. Main entry driven about one mile; employ about 80 men and seven mules in main air course; air current at upcast 170 feet per minute through aperture five feet three inches by six feet ten inches, showing a volume of 7,351 feet per minute. Keefer entry, 17 men at work; air current 40 fect per minute through aperture five feet three inches by six feet ten inches; mine ventilated by furnace drawing current through double entries; best system of ventilation yet seen; drainage good.

August 6. The Saltsburg coal company's mines, Westmoreland county. Main entry driven about 800 yards; employ 45 men and three mules; main air course, current 70 feet per minute, through aperture seven fect by five feet eight inches, showing a volume of 4,280 feet per minute; ventilated by furnace, but without apparent system; drainage very good.

August 7. The New York and Cleveland coal and gas company, Sandy Creek, Allegheny county. Mine No. 2. Main entry driven about 1,300 yards Employ about 50 men and 7 mules. No. 1 entry. A few men at work and not air current enough to move the anemometer. No. 2 entry. Five men and not air enough to move the anemometer. Corb entry. Twenty men and no current of air, with considerable percentage of carbonic acid gas. No system of ventilation observed. Main entry had a light air current, but not enough to turn the anemometer. Drainage fair.

Mine No. 3. Main entry driven 300 yards. Employ about 50 men and 11 mules. No. 1 entry. Twenty men and 2 mules. Small current of air, not enough to turn the anemometer. No. 2 entry. Twenty-two men and 2 mules. Driven out to day light. No perceptible air current. (Mr. O'Neill objects to this expression and says there was a perceptible current,) but not enough to move the anemometer. Richardson entry. Nine men and 1 mule, and no perceptible current of air. Mr. O'Neill notices that although the circulation was weak the air was pure. Drainage good with few exceptions.

August 11. Duquesne coal works, on Pennsylvania railroad, Allegheny county. Main entry driven about 300 yards. Employ 137 men and 3 mules. Duquesne entry, 36 men and 2 mules. Without current enough to move the anemometer. Kenedy entry, 60 men, without current enough to move the anemometer.

Dixon & Co.'s mines, Swissvale, Allegheny county. Did not find the pit boss or any one to show the works. So far as examined found small current of air with considerable of percentage of black damp. Pit sloppy in the entries. Noticed three openings, two drifts and one shaft.

August 12. The N. Y. & C. gas and coal company, Turtle Creek, Allegheny county. Main entry driven about 800 yards. Employ 111 men and ten mules, consists of numbers 2 and 3 pits connected. Nos. 2, 3, 4 and 6 entries work 21 men and 1 mule. Air current not sufficient to move the anemometer. No. 5 entry, works 15 men and 1 mule. Considerable black

damp lodged in one swampy place. Not enough air current found anywhere to turn the anemometer. Mr. O'Niell regards the air as generally quite good from which Mr. Archibald dissents.

No. 4. Main entry driven about 600 yards; employ 122 men and five mules; in main air-course current 100 feet per minute through aperture 7 feet 6 inches by 5 feet 7 inches, showing a volume of 5,737 feet per minute. No. 1, cross-entry 19 men and one mule; current cut off 200 yards from head of the entry, beyond which none but entry men worked. Main entry 64 men and two mules; current cut off about 180 yards from head of entry; drainage good and pit well managed and in good condition.

August 13. Penn Gas Coal company, Coal Run Mines, Westmoreland county. Main entries driven about 900 yards; employ 244 men and 24 mules. To these works there are two entries or pit-mouths; mines are aired by several drifts and furnace used for the outcast. No. 5, cross-entry current inside of air-course 130 feet per minute through an aperture 6 feet 3 inches by 5 feet, showing a volume of 5,191 feet per minute; works 30 men. No. 6, cross-entry is supplied with air from Nos. 5 and 7; current from said entries 80 feet per minute through aperture eight feet by five feet, showing a volume of 4,704 feet per minute; there are no break throughs in the rooms; works 50 men; the entry is driven about 250 yards beyond the cut-off of the air-course. No. 7 cross-entry, about 45 men and four mules employed; air-current per minute 63 feet through aperture 6 feet 10 inches by 4 feet 10 inches showing a volume of 3,339 feet per minute. Nos. 8 and 9 cross-entries are supplied from the outside; current 90 feet per minute through aperture 7 feet two inches by 5 feet 8 inches showing a volume of 5,170 feet per minute At present there only three men and one mule working in these entries, the entries being kept well ahead of the working. No. 9 lower cross-entry, about 55 men working and five mules; ventilated by air from Nr. 7 entry; air-current 85 feet per minute through aperture 6 feet 10 inches by 5 feet showing a volume of 4,184 feet per minute. No. 10 lower cross-entry is ventilated from No. 8; the mine is generally well drained; the entries and traveling-ways in good condition; the main entries are driven double to some extent and so arranged that the wagons run with the current of air.

August 14. Westmoreland coal company, Irwin Station, South Side, Allegheny county. There are employed about 248 men and 17 mules. Current of air at inlet, for the whole mine, 90 feet per minute, through aperture 7 feet 9 inches by 6 feet 9 inches, showing a volume of 6,659 feet per minute. The fifth dip cross entry is driven double. Twelve men working at present. Air current 55 feet per minute, through an aperture 5 feet 6 inches by 5 feet 6 inches, showing a volume of 2,824 feet per minute. The sixth dip entry is being driven, the entry men being the only persons employed in it; no air current noticeable. Main entries are driven double, and one of them is driven beyond the break, through about 60 yards. The lower fifth entry is also a double cross entry, working 29 men, is ventilated by air from the dip cross entries, and there is no noticeable current. Upper sixth cross entry, about eight men working. Supplied with air from the other entries; the current of air at outcast, near the furnace, is 125 feet per minute, through an aperture 8 feet 4 inches by 6 feet 6 inches, showing a volume of 8,734 feet per minute. The furnace is arched 31 feet in length, 7 feet in diameter; the grate bars are 8 feet in length, the stack 40 feet high, of solid brickwork; the capacity of the flue is 7 feet square; the furnace is kept going day and night; entries and traveling-ways are generally in good condition. The mining boss of this work, some years since, was killed in the mine by an explosion of gas.

The Old Larmer mines, same company as the foregoing, and adjoining Employ about 190 men and 18 mules; there is no furnace in use; has two openings by drifts, and one shaft. No current of air could be found in the main or cross entries where the miners are working, nor was there any current at the air courses, nor at the outlets that would move the anemometer. The air in this mine was generally oppressive, and the condition of the greater part of the entries was bad. Mr. O'Neill objects, that this statement is too strong, says while the air was not good, yet he did not find it oppressive.

August 15. Penn Gas coal company, shaft No. 1, Irwin Station, Westmorcland county. This shaft is one hundred feet deep, the hoisting shaft is also the incast, and by partition is made the upcast of the air course. The main entry is driven about 1,200 yards; employ about 196 men and boys and eight mules. The main entries are driven double, there are however three single cross entries and three double cross entries. The current of air at the intake for the whole mine is 40 feet per minute, just moving the anemometer, through an aperture 5 feet 7 inches by 5 feet 8 inches, showing a volume of 1,266 feet per minute. One of the main entries is used as an intake air course; the return airway is through the various entries and back to the shaft and upcast, which is operated by a fan ten feet in diameter. At the outcast the anemometer indicated a current of 40 feet per minute, through an aperture 7 feet 9 inches by 5 feet 3 inches, showing a volume of 3,206 feet per minute. This mine generates a considerable amount of explosive gas, two men having been killed in May last by an explosion in the main entry. It is claimed that the fan is now run day and night.

August 17. Penn Gas coal company, Penn station. These mines are worked by two main entries or drifts entering the north side of the bank. The easternmost drift or entry in No. 6 cross entry, some 26 miners are working. There is not a current of air sufficient to measure; the air is oppressive and smoky. The plan of ventilation is from an air course in No. 5 entry, and also from a shaft twenty-four feet deep and two feet square. Second cross entry, four men working and no perceptible current. No. 1 cross entry, driven to daylight, nineteen men and two mules working in it. In some places the roof is dangerous from crumbling of the rock and cracks; just about enough air current found here to move the anemometer; some of the entries and traveling ways in bad condition. In the westerly drift the main entry is driven about one and a half miles; it has three openings besides the main drift. There are in both drifts about 130 hands employed and seven mules; in one of the entries is a shaft about 30 feet deep for ventilation, but no perceptible air current; five men working in it. The Altman entry is claimed to be ventilated by a shaft 23 feet deep; 24 miners in it; air current not sufficient to move anemometer, very smoky in some of the rooms. No. 12 entry is claimed to be ventilated from the two last named entries; about 35 miners and five mules are employed; just sufficient air current to move the anemometer in a place seven feet by five feet. At an air shaft 103 feet deep at the head of the main entry, air was pure, but the current insufficient to move the anemometer; this air shaft is five feet square. The cross entry No. 5, from the main water level entry, works 14 miners, one mule; smoky—no air current. The same characteristics in all the rest of the cross entries. The main entries in these mines are evidently dangerous, cross timbers in some places are broken and hang insecurely. A few months prior to our visit, two persons were badly hurt in this entry by the falling roof, one of whom died in a few days, of his injuries.

August 18. The Loyalhanna coal and coke company, Latrobe, Westmoreland county. Shaft 132 feet deep; only one outlet; the shaft is the in and the upcast for air being partitioned; no furnace; a fan is used; about seventy men working with six mules. The main entry is driven about 500 yards; very little air current found anywhere; in one entry the air is close and smoky; some of the working places wet. (Mr. Stinner protests that this mine was very badly ventilated being smoky almost everywhere and no current found to move the anemometer anywhere. Mr. O'Niell says there was not a very good circulation of air, but the air was pure all through the banks except one entry and there the air was a little heavy; they were driving for a drift.)

Saxmon, Jr, & Co.'s mine, Latrobe, Westmoreland county. The main entry driven 400 yards; 39 men and 3 mules employed; found nowhere sufficient air to move the anemometer, except at the outcast and incast. No. 2 cross entry, 20 men working. No. 1 cross entry, 12 men working; the current at the incast was 220 feet per minute through an aparture 3 feet 10 inches by 5 feet 4 inches, showing a volume of 5,181 feet per minute; five daylight openings; the air seeemed to skirt along the edge of the working places to the outcasts of which there were two; found in one a current of 85 feet per minute in an aperture of 7 feet by 7 feet showing a volume of 6,000 feet per minute; and the other a current of 120 feet per minute in an aperture of 3 feet 6 inches by 5 feet 7 inches, showing a volume of 3,011 feet per minute; drainage good.

August 21. Fall Brook coal company, Tioga county. No 2 drift. The main heading or entry of this drift is driven 3,520 yards. This summer there are from 50 to 60 miners working, and ten mules with their drivers. There are in all thirteen cross headings or entries; the first five are driven 2,200 yards each, the remaining eight are driven about 330 yards each. The air current in this drift at the outcast was 180 feet per minute through an aperture of six feet by four feet seven inches, showing a volume of 5,902 feet per minute; did not measure the current at the inlet, but it was very strong; the air seemed to be well distributed through all the cross headings or entries in this mine; drainage good.

No. 3 drift. The main heading or entry is driven about 1,760 yards; there are 21 cross headings, and each one is driven an average of about 550 yards; there are employed about 150 miners and 28 mules and drivers. The air current at the outcast is 210 feet per minute through an aperture seven feet one inch by five feet three inches, showing a volume of 9,063 feet per minute; at the inlet the current is 265 feet per minute through an aperture five feet by four feet seven inches, showing a volume of 6,805 feet per minute, well distributed through the cross headings; drainage good.

Morris Run coal company, Tioga county. Drift No. 1. The main heading or entry is driven 2,640 yards; there are twelve cross headings, ranging from 860 to 870 yards; the workings are dry; employ about 100 miners and 17 mules with drivers. The air current at the incast is 350 feet per minute through an aperture nine feet by four feet ten inches, showing a volume of 16,508 feet per minute; at the outcast 135 feet per minute through an aperture twelve feet seven inches by five feet ten inches, showing a volume of 12,548 feet per minute; mine not working at time of examination; current well distributed.

New drift. Main entry driven about 900 yards; employ eighty men and eight mules; ventilated by furnace ten feet wide by nine feet deep; air current at outcast 250 feet per minute through an aperture sixteen feet three inches by three feet three inches, showing a volume of 14,920 feet per minute, which current is distributed through the various entries according

to the number of men employed, divided by regulators and overcasts, and returned to the upcast, thus securing to each entry the requisite amount of pure air according to the number of men at work; drainage fair.

August 22. Arnot Mines of the Blossburg coal mining and railroad company, Tioga county. No. 2 drift. Main entry driven about 1,850 yards; employ about 289 men and 35 mules with drivers; in this drift there are thirteen cross-headings or entries, the largest of which is 1,400 yards; ventilation by furnace; the air-current at the inlet is 50 feet per minute through an aperture seven feet four inches by six feet, showing a volume of 3,894 feet per minute. The current of air at the outcast near the furnace is 200 feet per minute through an aperture eight feet five inches by four feet showing a volume of 7,874 feet per minute; drainage fair.

No. 3 drift. Main entry driven 1,600 yards; employ 160 men and 13 mules and drivers. In this entry there are eight cross headings or entries driven from 600 to 700 yards; ventilation by furnace; the air shaft is 72 feet deep, six feet by five feet in capacity; the current of air at inlet was 370 feet per minute through an aperture four feet four inches by five feet two inches, showing a volume of 8,931 feet per minute; at the outcast near the furnace 195 feet per minute through an aperture six feet seven inches by four feet eight inches, showing a volume of 7,040 feet per minute; drainage not good in the main heading.

August 24. Penn Colliery at Houtsdale, Clearfield county. No. 1, or old drift; about ten men working; no air-current perceptible and drainage in poor condition. No. 2 drift or new mine; entry about 250 yards; employ thirty-five men and three mules; there are three cross-headings; in some of the air-courses there is no noticeable current; found the mines very smoky; they are about constructing a small furnace.

Franklin Mines, Houtsdale, Clearfied county. Main entry driven 1,000 yards; employ about 189 men and boys and — mules and drivers; there are four cross-headings, one 300 yards, one 100 yards, and the remaining two 50 yards each; ventilation by furnace with grate bars eight feet long by six feet wide in an arched furnace 18 feet long; stack 100 feet high from the fire; air-current at incast 125 feet per minute through an aperture nine feet three inches by three feet, showing a volume of 4,475 feet per minute. The air-current flows from one passage to the other until it passes through all the cross-headings. The current of air at the outcast is 240 feet per minute through an aperture six feet five inches by five feet three inches, showing a volume of 9,190 feet per minute. Some of the cross-headings are driven about 40 yards ahead of the air-course. With all of this current some of the cross-headings had not sufficient current of air to move the anemometer. The traveling-ways are generally wet, in some places the water being over the track.

August 25. Eureka mines, Houtsdale, Clearfield county. Main entry driven about 800 yards; employ 100 men and 9 mules with drivers; there are five cross-headings, three working at present; some are driven from 400 to 800 yards; ventilation by furnace; the air current at incast 43 feet per minute through an aperture 8 feet by 5 feet 6 inches, showing a volume of 3,595 feet per minute; did not measure at the outcast. The cross-headings are opened from 70 to 90 yards and ventilated by breasts driven through between them; found a current in No. 5 entry of 55 feet per minute through an aperture 3 feet 6 inches by 4 feet 2 inches, showing a volume of 1,361 feet per minute; drainage fair.

Sterling mine, Houtsdale, Clearfield county. Main entry driven about 850 yards; five cross-headings; employ about 134 men and 16 mules and drivers; ventilated by furnace with grate bars 4 feet by 3 feet; height of

furnace 2 feet 6 inches; no current found anywhere sufficient to move the anemometer; not enough to carry the powder smoke out of the entries. In this mine, while the entries were somewhat wet, the rooms were dry being higher than the entries.

August 27. Snow Shoe coal company, Centre county. In this mine there are three entrances, known as Nos. 3, 6 and 7 drifts, all being connected in the workings. The distances these entries were driven were not definitely ascertained; there were five cross-headings working; employed 90 men and 4 mules; the ventilation is sought to be produced upon the old English system of a *brattice* cut in the coal along the side of the main entry and boarded up, making an air course two feet by three. It failed to produce a noticeable circulation.

September 1. Blair mine, at Dudley, Broad Top, Huntingdon county. Main heading driven about 1,700 yards. Employ 12 men and two mules at present; not sufficient current of air anywhere to move anemometer; no furnace used; drainage bad, the entries being very wet and muddy. The rooms are dry, being worked on the high side of the entries, the veins having a pitch.

The Howe mine, near Dudley, Huntingdon county. Main entry driven about 500 yards. Employ 22 men and three mules; no furnace used; no perceptible air current to be found, not enough to carry off the powder smoke; the mine dry, making no water.

September 2. The Rockhill iron and coal company, East Broad Top. No. 1 drift. Main entry driven 500 yards. Four cross headings average 200 to 300 yards. Employ about 35 men and six mules. This is a new work, no rooms being worked yet; no air current found sufficient to move the anemometer; a furnace built, but not in use; in places the drain was stopped up with debris and consequently water stood in the traveling ways. Drift No. 2. Main heading driven about 500 yards Two cross headings, one 100 yards, the other 180 yards. Employ 22 men and two mules; a new mine, no rooms working; not enough air at incast to move the anemometer. In the air course from No. 1 to No. 2 cross entries, a small current, but not enough to move the anemometer, at the outcast or furnace, found to be 135 feet per minute through an aperture two feet two inches by one foot five inches, showing a volume of 525 feet per minute.

Carbon coal works, Mears, proprietor, near Broad Top City. Main heading driven about 500 yards Employ about 60 men and three mules and drivers; no furnace used; natural ventilation, two outlets beside the pit mouth; the air course is a sort of *brattice* built in the entry of the rock taken therefrom, the cross sectional area of which is about five feet six inches; no noticeable current; had not been working for two weeks. The entry is driven seven yards wide. This mine is dry, making no water.

Rickert Brothers, near Dudley. Main entry driven about 2,000 yards, employ 60 men and 8 mules; ventilated from works adjoining, where 25 hands are employed, the air being used after supplying them; found no perceptible current anywhere, the air heated and smoky, with considerable indications of carbonic acid gas. The pit boss said this was a fair specimen of the other entries. The main heading is in bad condition as regards drainage.

September 3. W. H. Piper's mines, Fairplay, Bedford county. Main entry driven about 1,700 yards; work four cross headings, which are driven from 100 to 400 yards; employ 41 men and four mules; has a furnace, but sometimes not used. Did not find air sufficient to move the anemometer at the incast, and at the face of the workings (headings and rooms) the air very close, especially in the dip entry. The current at the outcast 180 feet

per minute, through an aperture 3 feet 6 inches by 3 feet 1 inch, showing a volume of 2,257 feet per minute; mine dry, making no water.

R. B. Wigdon's shaft, Fairplay, Bedford county. Shaft 100 feet deep from landing to landing. Main entry driven about 500 yards, from cross headings driven from 70 to 200 yards; employ 40 men and three mules; use no furnace. The men pass in and out at the hoisting shaft; there is another opening, a shaft, but in a bad condition to get to it, without any ladder and dangerous, being no practical outlet in case of accident. No perceptible current found anywhere; at the face of the workings the air very oppressive; drainage fair.

September 4. Lloydsvale mines, Cambria county. Main heading driven about 800 feet, as stated by the pit boss; seven cross headings; employ 108 men and six mules and drivers. No. 5 heading two men at work, no perceptible current. No. 3 heading 14 men at work, no perceptible current. In passing through entry found considerable difficulty in keeping a light burning. C. No. 2 cross heading works 16 men; no current perceptible in air course, could hardly keep light burning. C. No. 1 cross heading works 36 men; no perceptible current. No. 2 cross heading, 24 men; a small current perceptible. Current at outcast 100 feet per minute, through an aperture 6 feet by 5 feet, showing a volume of 4,110 feet per minute, created by a small furnace 3 feet by 4 feet. The air courses are driven $2\frac{1}{2}$ by 5 feet; check doors standing open, not capable of being closed; drainage good.

September 8. Lemon Bank, near Galitzin, Blair county. Drift. Main heading driven about 700 yards; one cross heading working; employ sixteen men and two mules; use no artificial ventilation; the entry or traveling ways are generally wet; no perceptible air current, yet the air in the workings seemed pure; no standing smoke found except in one of the cross headings; the timbering was quite unsafe, having evidently been neglected.

Denis Porter & Co.'s shaft, Blair county. Depth of shaft 126 feet; two openings, one a shaft and one a drift; men can go in and out through the drift, but usually use the hoisting shaft. The main heading is driven about 600 yards; three cross headings, each driven about 900 yards; employ about fifty men and seven mules; no artificial ventilation; no perceptible current found. No. 1 and No. 2 entries are in a wet and sloppy condition; drainage very much neglected.

September 9. Bennington iron and coal company, Blair county. Shaft 180 feet deep to lower vein; 100 feet to vein at present being worked; two openings, one a slope by which the workmen go in and out, they not being permitted to use the shaft for that purpose. The main entry is driven about 400 yards on the south side and 300 yards on the north side; two cross headings on each side; employ seventy-one men and four mules. In main heading on the south side air current not sufficient to move the anemometer; same on the north side. Where the men are working the smoke stands and the air is very close; small current in main entry not distributed through the works; found in the outcast course, fifty yards from the shaft, a current of seventy feet per minute through an aperture four feet seven inches by two feet seven inches, showing a volume of 1,278 feet per minute. The traveling ways are generally in a wet condition as also the drift which serves for ingress and egress.

Kittanning coal company, Blair county drift. Main entry driven about 800 yards; two cross-headings, 300 yards each; one 400 yards and one 80 yards; employ 37 men and 3 mules; the inlet for ventilation is through an old mine adjoining and the outlet is the main entry; the mine had not been worked for three days prior to the examination, yet the air was very oppressive in some of the cross entries; the furnace used is $2\frac{1}{2}$ feet by $1\frac{1}{2}$ feet.

The main entry is in a wet and sloppy condition throughout the greater part and the mine generally is in a very bad condition.

September 10. Cambria steel and iron company's mines, Johnstown, Cambria county, drift. Two openings connected; the main entry of No. 1 drift is driven about a mile and three-quarters. That of the No. 2 drift unknown; employ 180 men and 26 mules; ventilated by furnace 5½ feet wide by 8 feet long; length of the arch 20 feet; found the current of air in the incast 2,000 yards from the pit, mouth to be 53 feet per minute through an aperture 5 feet 2 inches by 5 feet, showing a volume of 2,361 feet per minute; found the current in the outcast about 400 yards from the furnace to be 5 feet per minute through an aperture 5 feet 8 inches by 3 feet 4 inches, showing a volume of 847 feet per minute. The ventilation generally bad; in some of the working places very heavy with black damp, entirely unfit to work in; the mine was generally dry; the drainage being good. We were informed that this mine used to generate fire damp, but none had been noticed for some time.

Same company's slope—same place. The slope is about —— deep; the main entry is driven about a mile; there are four cross-headings worked at present—average about 900 yards each; employ at this time 55 men and — mules; ventilated by furnace 5½ feet wide by 8 feet long, and arch 20 feet long; found small current insufficient to move the anemometer, about a mile from the slope in the incast. In No. 3 cross entry, about 800 yards from the furnace in the incast found current of 170 feet per minute through an aperture 8 feet by 3 feet 4 inches, showing a volume of 5,477 feet per minute, and again at the furnace 240 feet per minute through an aperture 10 feet 4 inches by 4 feet, showing a volume of 11,276 feet per minute. Upon coming out found at the distance of 70 yards from the foot of the slope in the incast a current of 60 feet per minute through an aperture 12 feet 10 inches by 7 feet one inch, showing a volume of 8,927 feet per minute; drainage not very good and mine makes a great deal of water. There are besides the slope a horse way about 150 yards from the slope, and another outlet at No. 7 cross-heading about one and a fourth miles from the slope This mine generates explosive gas to some extent, resulting some time since, in the death of a boy from explosion by straying into the wrong passage.

September 11. Millwood coal and coke company, Westmoreland county. Shaft 203 feet deep, divided by a partition for up cast and down cast, this being the only opening to the mine; ventilated by a ten feet fan; main heading driven about 800 feet; employ 76 men and six mules; double main entry; air cut off over 200 feet from the head of the entry; air heated and close. Lower No. 1 cross heading works 18 men; no current perceptible; considerable powder smoke and black damp. No. 2 cross entry on the high side, about 38 men at work; small air current cut off about 80 yards from head of entry, inside of which nothing could be seen for smoke and damp, entry men say they have several times fell under its influence, and had to be carried out, ventilation throughout very bad; found the air current at the outcast at the shaft to be 100 feet per minute, through an aperture seven feet nine inches by four feet nine inches, showing a volume of 5,043 feet per minute, found no other current sufficient to measure.

September 15. Pittsburg and Connelsville gas and coal company, Connelsville, Fayette county. Slope 96 yards deep. Main entry from foot of slope, 550 yards. Three cross entries working; employ 50 men and four mules. Cross heading No. 1, full of smoke from the coke ovens, the wind blowing it in; no perceptible current; found in another part of the pit, in one of the entries, a current of 80 feet per minute through an aperture six

feet six inches, by six feet, showing a volume of 4,586 feet per minute, here there are 33 men working. In Burke's cross heading, eleven miners are working; no perceptible current and full of smoke, driven in by the wind from the coke ovens. As a general thing, with an exception here and there, the mine was very smoky from the coke ovens, but for this oven smoke, the mine would have been tolerably pure; drainage very good. This mine has two openings.

September 16. Hoggsett, Watt & Co., Mt. Braddock, Fayette county. Slope 300 yards; main heading driven 300 yards; three cross-headings, the longest one 300 yards; employ 36 men and four mules; two outlets besides the slope; no furnace or fan; current of air at outcast 57 feet per minute through an aperture 10 feet eight inches by six feet 10 inches, showing a volume of 6,946 feet per minute; no perceptible current anywhere else in mine, but owing to the size of the vein being eight feet high, the air is clear except toward the face of the workings a little smoke standing; drainage good.

Furguson Coal Works, Uniontown Branch, Fayette county. Slope 300 yards; main heading driven about 300 yards one side and 200 the other; no furnace or fan; no perceptible current to be found in this mine either at the inlet or outlet; generally smoky when the men are working; toward the head of the work found black damp near the floor; no appliances used to create a current; drainage good; two outlets.

S. W. Watt & Co., Uniontown Branch, Fayette county. Slope about 200 yards; main heading about 400 yards each side of slope; 22 men and two mules employed; no artificial ventilation; five openings beside the slope; air appeared very clear owing to the height of the vein and the miners being widely separated; no means used to distribute the air through the works; drainage good.

September 17. Mullen's Coal Works, Mt. Pleasant Branch, Westmoreland county. Drift. Main entry driven about 300 yards; employ 14 men and two mules; use very small furnace; no current of air perceptible anywhere in the mine; air very bad; they mix kerosene oil with the lard oil to make it burn, and then the lights burn very dimly; drainage fair; no means of distribution of air applied.

Boyle & Haslett, Mt. Pleasant Branch, Westmoreland county. A short slope driven in the vein about 30 feet; main heading about 200 yards; employ 17 men and two mules; no artificial ventilation; a cross heading worked with seven men driven about 100 yards ahead of the connection with the other entry; air heated and smoky, with black damp; air not distributed; no perceptible current anywhere found; two outlets besides the slope; drainage not very good, some parts of the headings being sloppy.

Buckey Works, Mt. Pleasant Branch. Drift. Main entry driven about 200 yards; rooms worked from the main entry; employ fifteen men and two mules; no artificial ventilation; no perceptible current found; where the miners are working it was found to be somewhat smoky and air close; two openings; drainage good.

Markle & Co., Mt. Pleasant Branch. Drift. Main entry driven about 500 yards; working at present two cross headings; employ fourteen men and two mules; no artificial ventilation; no perceptible current found anywhere; air somewhat smoky, especially in all the places where the men are working; drainage very good.

September 18. Markle & Sherrick, Mt. Pleasant, Fayette county. Drift. Main entry driven about 400 yards; three cross headings working; employ twenty-seven men and three mules; no artificial ventilation; two openings; found it smoky at eight o'clock in the morning in all entries

where the miners are working; very little air current found, not sufficient to move the anemometer; drainage good; air courses are being driven between the entries. This being the only pit on this branch that we have visited in which this has been or is being done.

Boyle & Playford's Mines, Mt. Pleasant. Drift. Two pits connected; Main entry driven about 560 yards; employ twenty-seven men and three mules; no artificial ventilation; the current along the main entry good, but not being distributed, the effect was to keep the foul air in the working places, also, carrying into the mine with it quantities of smoke from the coke ovens; a cross entry is being driven and is in about 100 yards; eleven miners are working there, and the sweep of the current through the air course forces the smoke from the coke ovens into this working place, effectually closing it in and preventing its escape; drainage good.

Hutchinson & Bros., Mt. Pleasant. Two pits connected; main entry driven about 400 yards; five cross headings are being worked; employ thirty-two men and two mules; found a current at inlet of eighty-nine feet per minute through an aperture of seven feet five inches by six feet four inches, showing a volume of 5,934 feet per minute; examined one cross entry where the air was smoky and badly ventilated, but generally the air was rather good through the mine; there is also in one part of the mine a double main entry; drainage good.

September 19. Wyman's mine, Wilkinsburg, Allegheny county. Two pits connected; main entry driven about 275 yards; employ 21 men and one mule; air current just sufficient to move the anemometer, through an aperture 4 feet 2 inches by 8 feet, showing a volume of 1,333 feet per minute; there are nine men working about 70 yards beyond this current where there is no perceptible ventilation and the air was close and heated; drainage fair.

Hampton coal company, Wilkinsburg. Drift. Main entry driven through the hill 350 yards; employ 56 men and three mules; no air current found sufficient to move the anemometer, but the air pretty clear. The main entry is continued on into the second hill one hundred yards. No. 1 cross entry driven about 120 yards; 20 miners working in it; no circulation of air and no other opening in this second hill, making it close, smoky and the presence of black damp; no artificial means of ventilation used; drainage fair.

September 29. Morgan & Co., Mt. Pleasant Branch, Fayette county. Drift—main entry driven about 300 yards; four cross entries working; has five openings; employ 37 men and five mules; not enough air current anywhere to move the anemometer and the air close and smoky where the men were working; no effort made at distribution of air; mine generally drained, except a few wet places.

Freck & Co., Mt. Pleasant Branch. Drift. Main entry driven 25 yards; four cross-headings working; have three openings; employ men and 32 four mules; no perceptible air current anywhere, especially where the men were working; no appliances for ventilation or distribution; drainage good.

September 30. National coal company, West Newton, Westmoreland county. Shaft 80 feet deep; main entry driven 300 yards; two cross entries working and a second face or main entry; employ 41 men and five mules; no artificial ventilation; air-current at upcast 65 feet per minute through an aperture five feet by three feet six inches, showing a volume of 1,083 feet per minute. The upcast is a shaft 60 feet deep with ladders for ingress and egress running straight up for men to climb; very dangerous. No. 1 cross entry, seven men working; no perceptible current; air close with a mixture of black damp; has 160 yards to drive before distribution can be got under the present system. No 2 cross entry, 22 men and one

mule working; no perceptible current anywhere in it; air heated and close toward the head of the entries.

We have to remark of this mine, that the shaft is close to the Yougiogheny river and the main entry is driven under the river; the coal worked out and the pillars crushing, which shows danger of falling, and at any time the water may break through and drown all the men in it in a few minutes. We so reported to the superintendent. The drainage is very bad, with the water pouring from the roof upon the traveling ways and in some places the water standing on the roads five or six inches deep.

White Heath coal works, near West Newton, Westmoreland county. Drift. Main entry driven about 400 yards; two cross entries; employ 65 men and four mules; no artificial ventilation; three openings; in No. 2 cross entry found a current of 90 feet per minute through an aperture seven feet four inches by five feet three inches, showing a volume of 4,911 feet per minute; 18 miners working. No. 1 cross entry, works 42 men; current 100 feet per minute through an aperture seven feet six inches by five feet two inches, showing a volume of 5,309 feet per minute; the air well distributed. These currents, however, were unsteady, sometimes slacking off; drainage good; found the current at the incast 150 feet per minute through an aperture seven feet eight inches by four feet two inches, showing a volume of 5,926 feet per minute.

October 1. Ocean Mines, Moore's Station, Westmoreland county. Drift. Main entry driven 1,200 yards; five cross entries; employ 109 men and seven mules; no artificial ventilation; three openings. No. 1, cross heading, works 40 men; not enough air-current to move the anemometer; ventilation cut off about 70 yards from the head; black damp present. No. 5, three men working; small air-current. No. 6, 30 men working; small current; black damp present at the head of the entry; drainage somewhat neglected, the roads being wet and muddy.

Youghiogheny Coal Hollow Company, Westmoreland county. Drift. Main entry driven 1,500 yards; eight cross entries driven a long distance, not ascertained; employ 210 men and fourteen mules and horses; no artificial ventilation; three openings. No. 1, cross entry; thirty men working; very small perceptible current. No. 2, sixty men working; no perceptible current, with considerable black damp. No. 4, forty-one men working; small current, mixed with black damp. No. 6, twenty men working; no noticeable current, considerable black damp. No. 8, thirty men working; small air current, with black damp. The traveling ways and entries are generally in a wet and bad condition, the drainage being bad.

October 2. J. N. Bigley, Alpsville, Allegheny county. Drift. Main entry driven about 1,500 yards; fifteen cross entries; when in full operation employ about 160 men, at present, sixty-five to seventy men and seven mules; no artificial ventilation; two pit mouths, eight openings in all. No. 8, cross entry; twenty-five men working; air current 150 feet per minute through an aperture five feet two inches by four feet six inches, showing a volume of 4,313 feet per minute. No. 11, cross entry; twenty-five men at work; air current 140 feet per minute through an aperture seven feet nine inches by five feet five inches showing a volume of 7,380 feet per minute. No. 2, main entry; current 60 feet per minute through an aperture seven feet ten inches by five feet, showing a volume of 3,846 feet per minute. All of these currents are fresh from the outside, well distributed; the mine is well ventilated and drained; we have seen no better.

C. H. Armstrong, Osceola, Allegheny county. Drift. Main entry driven about 900 yards; four cross entries in operation; employ 136 men and nine mules; no artificial ventilation; six or more openings. No 4, cross entry, no perceptible current; No. 5, cross entry, small current, just perceptible; works 45 men; air close and heated. No. 7, very small current; works 45 men; air close and oppressive; gets its air from No. 9, which also supplies the others, Nos. 4 and 5. No. 9, small air-current, not enough to move the anemometer in an aperture of three feet six inches by three feet six inches; this is the main current that supplies the whole works; drainage fair.

October 3. Armstrong Mines, Armstrong station, Westmoreland county. Drift. Main entry driven about 1,000 yards; employ 153 men and — mules; no artificial ventilation; seven horizontal openings and one shaft, the shaft being six inches by 12 inches; No. 14, cross entry, works about 30 men; small air-current, not enough to move the anemometer; considerable powder smoke; No. 12, 28 men, small perceptible current coming from No. 14; smoky in the working places; entries 160 yards apart and then intersected at about 100 yards by rooms to serve as air-courses. No. 13, works 22 men; attempted to be ventilated by perpendicular box 14 feet deep, six inches by 12 inches, which is a failure, the air being very close and smoky; this entry is driven 300 yards; no opening or connection with any other in that distance. No. 11, thirteen men; driven 300 yards; no air-current; not connected with any other for that distance; air close and smoky. No. 6, cross entry, driven out to daylight, 38 men; small current; drainage fair.

October 6. Fort Pit Mines, Pan-Handle railroad, Allegheny county. Drift. Main entry driven about 1,600 yards; employ 100 men, at present 64 and nine mules; no artificial ventilation; seven openings; at 1,100 yards from the incast found a current of 160 feet per minute through an aperture seven feet four inches by five feet nine inches, showing a volume of 8,231 feet per minute. Cross entry No. 3, driven to daylight; no perceptible current found in it; ten men working. No. 4, cross entry, found a current drawn from the outside, but not enough to move the anemometer through an aperture about seven feet by five feet; work three men. No. 2, cross entry, leads out to daylight; no perceptible current; works seven men. No. 5, cross entry, driven to air-course leading to daylight; current 45 feet per minute through an aperture seven feet six inches by five feet four inches showing a volume of 3,346 feet per minute; work 35 men. No. 6, cross entry, driven to air-course leading back to No. 4, current not sufficient to move anemometer through an aperture six feet five inches by four feet eight inches; work two men driving entry; drainage fair.

October 7. National Mines, Pan-Handle railroad, Allegheny county. Main entry driven about 800 yards; is a butt entry with rooms turned from it; work — men (work in the mines 126 miners and 16 day men, mules unknown;) not sufficient current to move anemometer; a face entry is driven from this main or butt entry, about 160 yards from which is started No. 6, cross entry driven back parallel with the main entry; not sufficient air-current to move the anemometer; work in this entry 60 men. No. 5, cross entry, works nine men; no perceptible air-current; not sufficient current found anywhere to move anemometer; drainage medium; roads somewhat wet.

Oak Ridge coal company's mines, Pan-Handle railroad. Main heading driven about 500 yards; works four cross-headings; work at present 60 miners, four day hands and three mules; no artificial ventilation; two openings. No. 1, cross-heading driven 300 yards; no perceptible current;

air course 80 yards from the face driven back to No. 4; air close; works about 30 men. No. 3 driven about 80 yards; works four men; no circulation, there being no connection for that purpose; air close and smoky. No. 2 driven in from the main heading 170 yards; no circulation and no connections for circulation. No. 4 cross-heading, distance driven not learned, is connected with No. 1 cross-heading by an air course, but there is no perceptible air current. They are just beginning to drive No. 5 cross-heading from a face heading; no perceptible current. The number of hands in the various workings could not be ascertained except as given in No. 1. There was no circulation anywhere in this mine sufficient to measure with the anemometer; the drainage was good.

October 8. Briar Hill coal mines, M'Donald Station, Pan-Handle railroad, Washington county. Main heading driven about 300 yards; working rooms from the main heading, which is also a butt heading, and from two cross-headings; employ 55 miners and four day hands with four mules; no artificial ventilation; there are three openings. No. 1 cross-heading driven 200 yards; number of hands 21; no perceptible current; connects with a worked out heading that leads to daylight. No. 2 cross-heading driven 300 yards; works 16 men; found a current of 20 feet per minute through an aperture 6 feet 10 inches by 5 feet 3 inches, showing a volume of 2,131 feet per minute, being brought from daylight direct. There are six men working in the main heading with not sufficient current to measure with the anemometer; drainage fair.

Laurel Hill mines, Pan-Handle railroad. Main heading driven double 700 yards; two openings; five cross-headings; employ 160 miners, 10 day hands and six mules; ventilated by furnace; did not find in main heading sufficient current to move the anemometer through an aperture about 7 feet by 5 feet 6 inches. No. 4 cross-heading, 25 men working; distance driven 112 yards; current from main heading not sufficient to move the anemometer; this current after flowing about 40 yards is lost by leakage through doors in the rooms or mouths of working places, beyond which distance it becomes smoky and toward the face is largely charged with black damp. In the air course leading to the return from No. 4 found a current of 110 feet per minute through an aperture 5 feet 3 inches by 3 feet 8 inches, showing a volume of 2,054 feet per minute, which current is cut off about 20 yards from the face of the main heading and is carried into the return air course or parallel main heading. No. 5 cross-heading driven 75 yards; works six men; no circulation, not having any connections for circulation; smoky and close with black damp. No. 3 cross-heading driven, (distance could not be ascertained;) works 40 men; no current perceptible; very close with powder smoke mixed with black damp. No. 1 cross-heading driven, (distance could not be ascertained;) works about 50 men; small air current, not sufficient to move the anemometer; which current is cut off about 100 paces from the fan, beyond which the air is very close with powder smoke and black damp. The current at the furnace was found to be 70 feet per minute through an aperture 10 feet 3 inches by 3 feet 4 inches, showing a volume of 5,898 feet per minute; drainage bad.

October 9. Midway coal company, Pan Handle railroad. Main heading (distance driven could not be ascertained); five openings; work at present five cross headings; employ ninety miners, seven day men and seven mules; have a furnace but make no use of it. No. 4, cross heading driven seventy-five yards (number of men working not ascertained;) found air current of ten feet per minute through an aperture seven feet by five feet, showing a volume of 1,740 feet per minute. No. 5, cross heading

driven 170 yards; hands unknown; current same as in No. 4. No. 8, cross heading not working, and we could not get in on account of water; were informed that there is in it explosive gases standing. No. 7, cross heading driven 400 yards; hands working unknown; not sufficient current to move anemometer. No. 3, cross entry, distance driven not ascertained; hands unknown; not sufficient current to move anemometer. No. 2, cross heading, driven 500 yards; hands unknown; not sufficient current to move anemometer; mine workings dry; traveling-ways some places wet; mine generates a great deal of water. On the north side new work is being opened. There is a main heading driven about 100 yards with two cross headings about 50 yards without any meaures being taken for ventilation.

Walnut Hill coal company, Pan-Handle railroad, Washington county. A slope, with a pitch of about five degrees, about 200 yards long; main heading from the foot of the slope 700 yards. There is another main heading parallel and about 300 yards distant which is driven 900 yards. The mine has two openings; six cross headings now in working condition; employ 160 miners, ten day men and nine mules; ventilated by an iron basket, in which the fire is kept, hung by chains in the air-shaft; found the current of air 60 yards from the upcast to be 25 feet per minute through an aperture eight feet by five feet, showing a volume of 2,570 feet per minute. No. 5, cross heading, from 30 to 40 men working; no perceptible air current; indications of black damp. No. 6, cross heading, driven from the new, or first mentioned main entry, has working 40 miners; no current perceptible; air very close. No. 6, cross heading, driven from the old, or last mentioned main heading 270 yards; work 30 men; no current perceptible in the heading or air-course and the heading is driven 120 yards beyond the air course. No. 5, cross heading driven from the old, or last named main heading; found no current of air, nor learned the distance driven. The remainder of the hands not mentioned in Nos. 5 and 6 of the new main heading work in this. This mine generates some explosive gases in the upper vein. We were informed that some time since four men were burned by an explosion of gas in this vein. The drainage was bad. The shaft for upcast is in the old parallel main heading and is used for pumping and ventilation. The upper vein mentioned overlies the lower vein, is about three feet five inches thick and lies near it. It is only worked when drawing pillars.

October 10. Carry & Co., Pennsylvania railroad, Allegheny county. Main heading driven 1,800 yards; seven openings in good order; six cross headings, but only work four at present; employ 86 miners, 11 day men and ten mules; no artificial ventilation; found current of air in main heading at the entrance to No. 16 to be 50 feet per minute through an aperture seven feet by five feet, showing a volume of 3,098 feet per minute. This cross heading is driven 500 yards and is open to daylight; works 16 men. No. 15, cross heading driven 100 yards, works two men; no circulation. No. 17, cross heading driven 400 yards to daylight; works three men; current strong; did not measure it. No. 18, cross heading driven 300 yards to daylight; not working at present; did not measure the current but it was strong. No. 14, cross heading driven 390 yards to daylight; work 51 men; found air-current to be 125 feet per minute through an aperture seven feet by five feet three inches, showing a volume of 5,926 feet per minute. No. 12, cross heading, driven 500 yards to daylight, works 16 men; found air-current to be 70 feet per minute through an aperture seven feet by five feet three inches, showing a volume of 3,965 feet per minute; drainage good.

October 12. Jones & Laughlin, South Pittsburg, Allegheny county. Main heading driven from inclined plane through three hills, a distance of one and three-quarters miles, and is now one thousand yards in the fourth hill; no artificial ventilation; five openings; five cross headings working; employ one hundred miners, seven day men and seven mules; there is a shaft at the face of the main entry for ventilation. No. 1, cross heading driven 200 yards; works eight miners; current not sufficient to move the anemometer. No. 2 is a short heading, about fifty yards, working two men, without connection for circulation. No. 3, cross heading driven 250 yards to daylight; works twelve men; not sufficient current to move the anemometer. No. 4, cross heading driven 226 yards to daylight; works thirty-nine men; found air current 180 feet per minute through an aperture seven feet eight inches by four feet six inches, showing a volume of 7,404 feet per minute. No. 5, cross heading driven 183 yards; works — men; not sufficient current to move anemometer The above headings are on the left side of the main headings; on the right side, Nos. 6 and 8, cross headings driven into Keeling's works adjoining; number working unknown; air on this side heavy and oppressive with black damp; drainage fair.

October 13. Castle Shannon Works, No. 1, South Pittsburg, Allegheny county. Main heading driven from the plane about two and a half miles and into the hill; they are working now 800 yards; no artificial ventilation; three openings; six cross headings; employ 160 miners, eleven day hands and ten mules. No. 14, cross heading driven one hundred yards to line heading; men working unknown; small current, not sufficient to move anemometer. No. 13, cross heading driven 250 yards into the line heading; men working unknown; current just enough to move the anemometer, through an aperture six feet two inches by four feet eight inches, showing a volume of 1,157 feet per minute; this current is not steady but variable. No. 11, cross heading driven 450 yards to line heading; number working not known; current not sufficient to move anemometer. No. 15, cross heading driven 300 yards; number working unknown; no current perceptible; some standing smoke. No 12, cross heading driven 300 yards; number working unknown; no perceptible current; drainage good.

Castle Shannon works No. 2, South Pittsburg. Main heading driven from plane three miles to the hill at present being worked and into the hill two parallel main headings 190 yards apart; one driven 120 yards and the other 183 yards. There is a cross-heading 83 yards from the drift mouth leaving the main heading 100 yards and the other 37 yards beyond the air course; employ 40 miners, three day hands and two mules; not sufficient air current to move the anemometer; found some standing smoke; drainage good.

October 14. Joseph Keeling & Co., South Pittsburg, Allegheny county. Main heading driven from plane about two miles and into the hill at present being worked about 850 yards; two openings; no artificial ventilation; employ 175 miners, nine day men and seven mules; seven cross-headings 160 yards apart and intersected every 150 yards. No. 1 cross-heading driven 104 yards to the Locomotive or Smoky tunnel; 18 miners working in it; no perceptible current. No. 3 cross-heading driven 175 yards to the same tunnel; 28 men working; no current perceptible. No. 5 cross-heading driven 240 yards to the same tunnel; number working unknown; no perceptible current; the smoke from the Locomotive tunnel forces its way into these three headings and lays there, in fact prevades the workings generally. No. 6 cross-heading driven 300 yards; 26 miners working; no perceptible current; air heated and smoky with black damp mixed; an air course is cut from this to No. 7; the head of No. 6 being 100 yards beyond

this air course. No. 7 cross-heading driven 350 yards; no one working in it at present; found an outcast of air toward the shaft 60 feet per minute through an aperture 4 feet by 1½ feet, but this current drew the smoke from the Locomotive tunnel; this heading is driven 125 yards beyond the air course. No. 4 cross-heading driven 375 yards; 33 miners working; no perceptible current; air close and oppressive with black damp; the air course from Nos. 6 and 7 connects with this heading. No. 2 cross-heading driven 375 yards; 40 men working; air close and oppressive; no perceptible current; the air course from No. 4 connects with it and the heading is driven 100 yards beyond the air course. In headings Nos. 2, 4 and 6 no current is perceptible except when the air is disturbed by the movement of the cars; drainage good. The locomotive referred to here is used to draw the coal from the mine through the tunnel to the top of the plain at the landing.

October 15. Keeling & Co's., Upper Works, South Pittsburg. Main heading driven from top of plane two miles and into the hill at present being worked, the main heading of the old works is driven about 1,000 yards; no artificial ventilation; three openings working two cross headings. No. 12, cross heading, distance driven could not be ascertained; 25 miners working; no perceptible current; air close. No. 14, cross heading, driven 600 yards to daylight; 60 miners working; small unsteady current, depending upon the movement of the cars, not enough to move the anemometer; some standing smoke where cars are standing; drainage good. The main heading of the new works driven 700 yards; no artificial ventilation; three openings; four cross headings. No. 1, cross heading, driven 200 yards to an air shaft; 25 miners working; no perceptible current. No. 3, cross heading, driven 300 yards; three miners working; small current which goes to the air shaft in No. 1, not sufficient to move the anemometer. No. 2, cross heading driven 500 yards; 32 miners working; small perceptible air-current flowing to daylight; some smoke from combustion of lights and exhalations from the workmen. No. 4, cross heading driven 150 yards, not working at this time. The number of hands to the two works is 200 miners, 18 day hands and 15 mules; drainage good.

October 16. H. B. Hayes & Bros., Beck Run, Allegheny county. This mine consists of five several openings. The first or main tunnel is driven 650 yards from which there are four cross entries driven, with several openings to daylight, one of them a shaft 85 feet deep for ventilation; no furnace or fan. No. 1, cross heading driven (distance not ascertained) six men employed; found air-current 80 feet per minute through an aperture seven feet by eight feet two inches, showing a volume of 6,723 feet per minute. No. 2, cross heading, driven (distance not ascertained) but connects with an air-course on the line of their land; not working at present; not enough current to move the anemometer. No. 4, cross heading (length not given,) six men working; cut through to line air-course; not enough current to move the anemometer. No. 6, cross heading, (distance not known,) ten miners working; not current sufficient to move anemometer, what there is, is fresh from daylight. These headings are 180 yards apart with cross headings 160 yards apart; drainage good. Log-house heading is a cross entry driven 330 yards to an air-course leading from the tunnel last described; 20 men working; no perceptible current; close and smoky, with considerable black damp. Cut-and-dry heading is a cross entry driven about 300 yards through the hill; about 40 men working; not sufficient current to move the anemometer through an aperture seven feet 10 inches by seven feet four inches. Watson's No. 1, heading is also a cross entry

driven 200 yards through the hill; 25 men working; current small; not sufficient to move the anemometer through an aperture seven feet four inches by five feet nine inches. Watson's No. 2, heading is a cross heading also driven through the hill a distance of 150 yards; 25 men working; not current sufficient to move the anemometer through an aperture six feet four inches by five feet six inches; drainage fair;

October 17. Habermann & Co., Baldwin township, Allegheny county. Main heading driven through the first hill from the top of the plane about a mile and into the hill now being worked, 1,100 yards. Claimed to be ventilated by the heat from the boilers of a small pumping engine placed 800 yards from the pit mouth on the main heading, and by a line heading leading to daylight; five openings; 160 miners, day hands and nine mules; twelve cross headings, six working at present. The main heading is driven about 300 yards beyond the air shaft, where four men were working; found it full of standing smoke and the air oppressive, the current being out off at the air shaft, where we found a current of ten feet per minute, through an aperture nine feet eight inches, by six feet four inches, showing a volume of 3,043 feet per minute. No. 11 cross heading, two men driving heading; no perceptible current, air close and oppressive. This entry is driven ten yards, and has to be driven ninety-three yards yet before it gets circulation. No. 9 cross heading, driven 115 yards; two men working; no current, air close, smoky and heated. No. 7, driven 250 yards; 22 miners working; found no current in the heading or in the air course leading to No. 5, air close, smoky and heated. No. 5 cross heading, driven 312 yards to the line heading; sixty men working; found an air current of eighty feet per minute, through an aperture three feet three inches by three feet four inches, showing a volume of 1,274 feet per minute. No. 3 cross heading, driven 315 yards into the line heading; 20 men working; found an air current of 80 feet per minute, through an aperture three feet eight inches by three feet six inches, showing a volume of 1,059 feet per minute. No. 2 cross heading, driven 150 yards to an air course; five men working; not sufficient current to move anemometer; drainage good.

October 19. Hayes & Bro., Six Mile Ferry, Allegheny county. Main heading driven about 700 yards; three cross headings worked at present; no artificial ventilation; 125 miners, eight day hands and six mules. No. 9, cross heading 550 yards to the line entry; fifty miners working; found air current to be fifteen feet per minute through an aperture six feet nine inches by five feet nine inches, showing a volume of 2,117 feet per minute. No. 8, cross heading driven 550 yards to the line entry; seventy miners working; found air current just enough to move the anemometer through an aperture seven feet nine inches by five feet seven inches, showing a volume of 1,731 feet per minute. No. 7, cross heading driven 550 yards; six miners working; not sufficient current to move the anemometer; drainage good.

Risher's Mine, Six Mile Ferry. Main heading driven 550 yards; six cross headings working at this time; no artificial ventilation; three openings; 100 miners, seven day men and six mules employed. No. 7, cross heading driven 175 yards; works two miners; air very foul with black damp, there being no connection for circulation; the heading is being driven for air, the distance yet to go being about twenty yards. No. 6, cross heading driven fifty-two yards into old workings; working nine men; small air current perceptible, not sufficient to move the anemometer; air mixed with black damp. No. 5, cross heading driven 175 yards to an air shaft; eighteen miners working; current at the air shaft ninety feet per

minute through an aperture three feet six inches by one foot eight inches' showing a volume of 743 feet per minute; this is the outcast for Nos. 1 and 3 cross headings. No. 4, cross heading driven 225 yards into old workings; twenty miners working; found air current 150 feet per minute through an aperture three feet four inches by one foot, showing a volume of 485 feet per minute. No. 3, cross heading driven 400 yards, connecting with an air course from No. 1; thirty-five miners working; found air current forty feet per minute through an aperture two feet ten inches by two feet six inches, showing a volume of — feet per minute. No. 2, cross heading driven 200 yards to the old workings; twenty-one miners working; small current found, not enough to move the anemometer. No. 1, cross heading driven 400 yards; fourteen miners working; small perceptible current, being the same as described in No. 3, which flows through this heading. This heading is driven 140 yards beyond the air course; found an air current at the main incast, 140 yards from the pit mouth, thirty feet per minute through an aperture seven feet by five feet four inches, showing a volume of 2,580 feet per minute; this being the supply for the whole mine, except No. 1 cross heading; drainage good.

October 20. Neal & Oliver's mine, opposite M'Keesport, Allegheny county. Main heading driven through the first hill 1,000 yards and into the present workings 400 yards; no artificial ventilation; 3 cross-headings; four openings; employ 90 miners, eight day men and six mules; found current at the incast near the pit mouth 25 feet per minute through an aperture 12 feet by 5 feet 8 inches, showing a volume of 4,369 feet per minute. No. 5 cross-heading driven ———; 12 miners working; current of air 90 feet per minutes through an aperture 7 feet 8 inches by 1 foot 2 inches, showing a volume of 1,139 feet per minute. No. 3 cross-heading driven ———; 40 miners working; current of air not sufficient to move the anemometer; the heading is driven 200 yards beyond the air course. No. 1 cross-heading driven ———; 25 miners working; no perceptible current of air; the air course between this and No. 3 is a very small hole; the heading is driven about 70 yards beyond this air hole; drainage good.

William Neal's mines, M'Keesport. Main heading driven 1,500 yards; ventilation by furnace placed by side of the main heading; three openings; four cross-headings working; 32 miners, two day men and two mules; found air current at the furnace to be five feet per minute through an aperture 9 feet by 6 feet 5 inches, showing a volume of 2,590 feet per minute. No. 14 cross-heading driven ———; 15 miners working; not sufficient current to move the anemometer. No. 15 cross-heading driven ———; 14 miners employed; not sufficient current to move the anemometer. No. 17 cross-heading driven 300 yards; one man driving heading; no connection for circulation. No. 11 cross-heading driven ———; four men working; small perceptible air current; not sufficient to move the anemometer; this small current is from an air course crossing to Nos. 14 and 15; drainage good.

October 21. William Stone, M'Keesport, Allegheny county. Main heading driven through two hills one mile and into the hill now being worked about 600 yards; no artificial ventilation; — openings; four cross headings driven ——; 20 miners working; not sufficient current to move the anemometer in an aperture five feet by three feet; driven about 50 yards beyond the air course; a little smoke standing. Jackson cross heading; 12 miners working; not sufficient current to move the anemometer in an aperture four feet six inches; heading driven 150 yards beyond air-course; air close and

heated. Gomer's cross heading, 15 miners working; driven to daylight; current of air 60 feet per minute through an aperture three feet seven inches by three feet 11 inches, showing a volume of 1,378 feet per minute. This current is unsteady; drainage good.

October 26. Risher's Upper Mines, M'Keesport, Allegheny county. Main heading driven about 400 yards; seven openings; five cross headings; no artificial ventilation; employ 110 miners, nine day hands and eight mules. No. 2, cross heading driven 1,170 yards; 60 miners working generally. Swamp cross heading, 16 miners working. No. 1, cross heading, driven 1,500 yards to an air-course. No. 3, cross heading, driven about 700 yards on one side of the face entry and crossing the same to a distance not ascertained. The mine had not been in operation for a week but appeared to be well ventilated; drainage good.

Risher's Lower Mine, M'Keesport. Had not been working for a week at the time of examination; main entry driven 1,600 yards; four openings; three cross headings, but only working two when running; employ 98 miners, 10 day hands and nine mules; no artificial ventilation. No. 3, cross heading driven 580 yards to a slope at the outlet; 49 men working when running; not sufficient current to move the anemometer. No. 4, cross heading driven 480 yards; 49 miners employed when running; is ventilated by an air course from No. 3 cross heading, but did not find sufficient current to move the anemometer. No. 6, cross entry, driven 280 yards; no rooms yet opened; is connected with an air course from Nos. 2 and 3 cross headings; not sufficient current to move the anemometer; drainage good.

October 27. Lysle & Son, above M'Keesport, Allegheny county. Main heading driven 1,500 yards, through the first hill into the second; no artificial ventilation; seven openings; eight cross headings working; employ 130 miners, ten day hands and nine mules. There are 25 miner's working rooms in this main which is also a butt heading; there is no current of air perceptible. Watkin's heading, in the first hill, nine men working; no perceptible current. There are six headings in the second hill all driving headings except in No. 1 in which four men are working rooms; the length of the headings are from 100 to 300 yards with no connection for circulation yet, which will not be reached until the blocks are cut. Pikes Peak cross heading, in the first hill, driven 400 yards; 30 miners working; not current enough to move the anemometer. This heading is driven 135 yards beyond the air course; air close; drainage good.

Wigham, Baily & Co., Allegheny county. Mine has been idle for some time. Main entry driven through the first hill 725 yards, from thence the main heading is driven in 800 yards; no artificial ventilation; a number of openings; work five cross headings at present; employ when running full, 100 miners, seven day hands and seven mules. Chambers cross heading is driven in 500 yards; 25 miners working; very small perceptible current of air, which is claimed to come through the air course from No. 4 heading. Briggs' heading is driven in 444 yards; 20 miners working; no perceptible current; connected by an air course from No. 4 heading. Cathry cross heading, newly started, only driving the heading when working; no perceptible current. M'Ginus' cross heading, 15 men working; current nearly enough to move anemometer. The last two headings are driven to daylight. The mine had not been in operation for sometime previous to examination; drainage good.

October 28. Rock Run Mines, Culp & Gable, Allegheny county. Main heading driven from top of plane to mouth of pit, 900 yards; in the hill now being worked 500 yards; three openings; employ about 80 miners,

five day hands and four mules; no artificial ventilation; four cross headings. This main heading is also a but heading, and works 50 miners; very small perceptible current in an aperture seven feet six inches by five feet. Chapman heading; eight men working; not sufficient current to move the anemometer in an aperture six feet six inches by four feet ten inches; is driven 50 yards beyond the air course. Face heading driven to daylight; current nearly enough to move the anemometer in an aperture seven feet two inches by five feet four inches. Peaches heading, driven to daylight; five men working; not a sufficient current to move the anemometer. No. 1, Gibb heading, driven 150 yards; seven men working; not connected anywhere yet for circulation; drainage good. This pit appeared to be pretty well aired, the instrument was found to be out of order at this time, so that its indications here are not reliable. The mine had not been working for some days previous to the examination.

November 10. R. M. Blackburn & Co., Coal Valley, Allegheny county. Main heading driven 800 yards from the top of plain to the second hill; in the hill now being worked, there are three headings driven parallel with each other at distances of 128 yards and 144 yards apart. These are worked as cross-headings, the rooms being turned from them, no artificial ventilation; employ, when running full, 90 miners, 9 day hands and eight mules; 4 openings; at present only about 25 miners are employed. No. 1. cross heading is driven 500 yards; 130 yards from the face of this heading an air course intersects it at which point we found a current of 60 feet per minute through an aperture 3 feet 10 inches by 3 feet 8 inches, showing a volume of 1,380 feet per minute; heading driven 75 yards beyond an air course connecting this with No. 2. No. 2 cross-heading driven 450 yards; number working, not learned; aired from No. 1, found current where the air course intersected this entry 30 feet per minute through an aperture 4 feet 9 inches by 1 foot 10 inches, showing a volume of 602 feet per minute; heading driven 140 yards beyond the air course. No.3 cross-heading driven 450 yards; no perceptible current; there were six rooms working in this heading beyond the air course; the air was very oppressive at those rooms and also at the face of the heading; drainage good.

Robbins and Jenkins, Coal Valley. Main heading driven about 1,500 yards; an outlet either by drift or shaft for each cross-heading; 7 cross-headings; examined three; no artificial ventilation; employ about 180 miners when running full; at present 80 miners, 8 day meu and seven mules. Green heading is driven 300 yards to a drift outlet; no miners working in it; found a current of 140 feet per minute through an aperture 6 feet 2 inches by 5 feet, showing a volume of 5,420 feet per minute. No. 3 cross-heading driven 450 yards to an outlet; found an air current about enough to move the anemometer in aperture 7 feet by 5 feet. No. 5 cross-heading is driven 700 yards to an outlet; small current not sufficient to move the anemometer. This heading is wet in some places but the miners worked dry in the rooms.

November 11. Lynn, Wood & Co., Pyne Run, Allegheny county. Main heading driven 500 yards; no artificial ventilation, but the plan of the mine includes a furnace which is not yet built; two openiugs; five cross entries; employ about 60 miners, 4 day hands and three mules; current of air nearly enough to move the anemometer in au aperture 7 feet by 5 feet; the air course leads to daylight. Nos. 3 and 4 cross-headings driven parallel four yards apart; work respectively 16 and 20 men; current about sufficient to move the anemometer. Nos. 5 and 6 cross-headings driven parallel four yards apart about 100 yards; two men in each driving entry;

supplied by current from No. 4, flows in No. 5 and out through No. 6 and out through double parallel main heading to the outcast. This system with a furnace or fan to create a current is the best known and worthy the attention of all mine operators; drainage good.

Joseph Walton, near West Elizabeth, Allegheny county. Main heading driven 1,600 yards from plane; no artificial ventilation; four openings; six cross-headings; employ 70 miners, 12 day hands and ten mules. No. 4 cross-heading driven 500 yards to day light; 30 men working; current of air not sufficient to move the anemometer and unsteady. No. 1 cross-heading driven 450 yards; 28 men working; current small and unsteady No. 2 cross-heading driven 105 yards; two men working; air current from a neighboring work; small and unsteady, mixed with black damp. No. 3 cross-heading driven 105 yards; not enough current to move the anemometer; remainder of the hands work here; drainage neglected in some places.

November 12. G. & W. Jones, above West Elizabeth. Main heading driven about 1,000 yards; no artificial ventilation; five openings; six cross headings; employ ninety-four miners, six day hands and six mules. No 1, cross heading driven — yards; sixty men working; current small and unsteady, flowing through an air course to daylight. An air course from about midway of No. 1 is driven to daylight, from which the Jackson heading is driven about 140 yards without any connection for ventilation; two men work here driving the heading. No. 7, cross heading driven 250 yards to an air course connected with No. 5; small current, insufficient to move the anemometer. No. 6, cross heading is driven 300 yards; seventeen men working; not sufficient current to move the anemometer in a line air course. No. 5, cross heading driven 300 yards; four men working; air current not sufficient to move the anemometer. No. 4, cross heading driven 350 yards to the line air course; eight men working; found an air current forty-seven feet per minute, through an aperture of seven feet five inches by four feet two inches, showing a volume of 2,645 feet per minute. There is also a small entry called No 1½ driven 175 yards to an air course connecting with No. 1; eight men working in it; not enough current to move the anemometer; drainage good. Not running at time of examination.

Walton & Haberman, above Elizabeth. Main heading driven through the first hill about 600 yards; employ 135 miners, eight day hands and seven mules; current passing through main heading 120 feet per minute through an aperture seven feet four inches by seven feet, showing a volume of 8,028 feet per minute. No. 3, cross heading driven 200 yards to daylight; twenty-five men working. No. 5, cross heading driven 404 yards to line air course; twenty men working. No. 4, cross heading driven 360 yards to line air course; fifty men working. No. 2, driven — yards; four men working. No. 1, driven — yards; seven men working. The air current in all these headings is nearly enough to move the anemometer, except in No. 1, which is weaker. Main heading in the second hill driven 1,500 yards; no artificial ventilation; two openings; seven cross headings; only working at driving headings. These headings are 165 yards apart and intersected at every 200 yards; one is driven 1,100 yards and nearly 500 yards beyond the air course, and must yet be driven about 200 yards before it gets circulation. The main heading of this work is double; drainage good.

November 13. Cliff mines, Washington county. Main heading driven 1,250 yards; ventilated by furnace; two openings; 10 cross-headings; employ 90 miners, 12 day hands and 8 mules; this mine is worked with the double entry system. No. 5 cross heading driven —— yards; 25 men work-

ing; not current sufficient to move anemometer; driven about 40 yards beyond the air course. No. 6 driven —— yards; 12 men working; not enough current to move the anemometer. No. 9 driven 300 yards; not current enough to move the anemometer; this current is drawn through 5 and 6. No. 10 driven 300 yards; three men working; not enough current to move the anemometer, air heavy with powder smoke; at the head of main heading it is smoky with black damp mixed; small air current from the before described entries. No. 12 driven 100 yards; one man driving heading; small current flowing from the before described headings; this heading is driven 30 yards beyond air course, air close and smoky. No. 11 same as No. 12. No. 7 one man working; current same as No. 11, except there is more black damp; the remaining headings employ the balance of the men and the same description applies to them except that the air becomes more vitiated as it proceeds. No current was found sufficient to move the anemometer except at the furnace where it is 235 feet per minute through an aperture 6 feet 9 inches by 5 feet 6 inches showing a volume of 9,948 feet per minute; drainage good. These headings all make more or less explosive gases, except five and six. The system in this mine is good, but loses circulation by leakage in doors, &c., which can be easily remedied.

Coal Bluff mine, Washington county. Main heading driven about 1,075 yards; ventilated by furnace; six openings; six cross headings; employ 60 miners, six day hands and 5 mules when working. The main heading is driven double, 21 feet apart; the current at the distance of about 750 yards from the mouth, is 105 feet per minute through an aperture six feet nine inches by five feet, showing a volume of 4,787 feet per minute. Nos. 7 and 8 cross headings, also double headings about 21 feet apart; men driving headings; driven 80 yards; current 100 feet per minute through an aperture five feet four inches by four feet six inches. Nos. 5 and 6 also double headings, 21 feet apart, nine and thirteen men respectively working; driven abovt 160 yards; current 70 feet per minute through an aperture five feet six inches by five feet two inches.. Nos. 3 and 4 also double cross headings 21 feet apart; 13 men in each; current 140 feet per minute through an aperture four feet six inches by four feet; current at upcast 130 feet per minute through an aperture seven feet by four feet ten inches, showing a volume of 5,620 feet per minute; drainage good; mine not worked for a week when examined.

November 14. Cincinnati mine, Washington county. Main heading driven about 1,200 yards; double main and double cross headings; ventilated by furnace; one opening; cross headings; 85 miners, six day hands and five mules. Nos. 3 and 4 driven about 378 yards; each work respectively 26 and 29 men; current in air course 54 feet per minute through an aperture three feet six inches by three feet ten inches, showing a volume of 1,239 feet per minute; considerable powder smoke. Nos. 5 and 6 driven about 80 yards; work five men in No. 5; No. 6 not working; no connection for ventilation; in No. 5 considerable black damp. No. 7 and 8 driven about 52 yards; work five men each; (not working at time of examination) no connection for ventilation. Nos. 1 and 2 driven nearly 600 yards; 12 men working. This is the main current for the mine and was not enough to move the anemometer through an aperture seven feet by four feet three inches; current at the furnace 320 feet per minute through an aperture five feet nine inches by three feet ten inches, showing a volume of 7,723 feet per minute. This mine, like most of those in this region, generates more or less explosive gases; drainage good.

Buffalo and Monongahela mines, Washington county. Main heading driven double one and a half miles; ventilated by a furnace; one opening; four cross-headings driven as double headings; employ 60 miners, 6 day hands and five mules. Nos. 1 and 3 driven 450 yards; 14 and 18 men working; current in air course between Nos. 1 and 3 not enough to move the anemometer; air oppressive and mixed with considerable black damp. About half way to the face of No. 1 a strong flow of black damp issues from old workings which is taken up and carried by the current through all the workings. Nos. 2 and 4 driven 180 yards; 12 and 11 men working; current flowing from No. 3 not sufficient to move the anemometer; air oppressive with black damp and powder smoke; some explosive gas generated; drainage good.

November 16. Warren & Co., near Monongahela City, Washington county. Main heading driven double about 500 yards; ventilated by small furnace used for the boilers and steam pump; openings—three cross-headings single; employ 45 miners, 4 day hands and four mules. No. 7 cross-heading driven about 400 yards; current from main incast nearly enough to move the anemometer in an aperture 5 feet 4 inches by 5 feet 4 inches; 25 men working when full. No. 4 driven about 400 yards; 42 men working when full; current from No. 7 not sufficient to move the anemometer. The pumping engines stand about 50 yards back from this heading and about half way from the face to the main entry; found at the outcast at the pumping engine a current of 130 feet per minute through an aperture 5 feet 4 inches by 4 feet 4 inches, showing a volume of 3,839 feet per minute. No. 6 driven about 200 yards; air course connects with No. 5; current not sufficient to move the anemometer; the heading is driven about 40 yards beyond the course; air close; two men driving heading. This mine like most in this region generates explosive gases. This last summer the mining boss got badly burned by an explosion in a room not more than ten yards from the heading; drainage fair.

Steibs coal mines or Harlan coal company, Washington county. Main heading driven about 800 yards; four cross headings; two openings; ventilated by furnace; employ 75 miners, seven day hands and four mules. No. 3, heading, driven 400 yards; 20 men working; current from line air-course not enough to move the anemometer in an aperture seven feet by five feet. No. 4, driven 130 yards to line air-course; 15 men working; small current flowing from No. 6. No. 6, driven — yards; 22 men working; current very small flowing from No. 5. No. 5, driven about 160 yards to an air-course connecting with No. 3; small current perceptible; heading driven 80 yards beyond air course; found the current nowhere in the mine sufficient to move the anemometer; muddy and badly drained generally; mine is difficult to drain; not working at time of examination.

November 17. W. H. Brown, near Monongahela City, Washington county. Main heading driven double about 1,500 yards; ventilated by furnace; three openings; 12 cross headings, single; 125 miners employed, 10 day hands and seven mules; at incast about 1,200 yards from pit-mouth ound a current of air 43 feet per minute in a passage eight feet by four feet 10 inches, showing a volume of 3,159 feet per minute; heading driven about 60 yards beyond air-course; at the face stood powder smoke. No. 14 cross heading driven 60 yards; two men working; no connection for ventilation. No. 13, driven 70 yards; two men working; ventilated by *brattice* about 18 inches wide and five feet high, which was about fifty yards from the face of the heading; air close. No. 12, driven 100 yards; no connection for ventilation; two men working. No. 11, driven 120 yards; two

men working; ventilated by *brattice* 16 inches by five feet and in it a current nearly strong enough to move the anemometer. No. 9 driven 400 yards; eleven men working; current from 12 to 14 by air course out from No. 7, found to be 60 feet per minute through an aperture seven feet by five feet, showing a volume of 3,437 feet per minute. Nos. 10 and 8, each driven 80 yards; no connection for ventilation. No. 7, driven 300 yards; 60 men working; current at furnace 310 feet per minute through an aperture eight feet by six feet three inches, showing a volume of 17,035 feet per minute, a considerable portion of which does not circulate through the works. No. 6, driven 60 yards; two men working; no connection for ventilation. No. 5, driven 275 yards; 15 men working; small current; drainage good.

Cokain's Mines, Washington county. Main heading driven about 600 yards; ventilation by small furnace; two openings; three cross headings; forty miners, four day hands and four mules employed. No. 5, driven 150 yards; four men working; has to be driven 150 yards more before it gets to an air course for circulation; found some standing smoke from the few men working. No. 6, driven 400 yards to an air course open to daylight; twenty men working; small current, not enough to move the anemometer. No 4, driven 300 yards to the above air course; four men working; no perceptible current. Main heading driven about seventy yards beyond air courses. The air at the head or face of this the main heading is impregnated with powder smoke and black damp. An air course has been started at No. 6, running parallel with the main heading about seventy yards, but no connections have been made; no one working at time of examination except those driving headings; drainage good.

November 18. Gilmore's Mines, Washington county. Main heading driven 1,670 yards; ventilation by furnace; two openings; four cross headings; employ 48 miners, five day hands and four mules. There are two face entries driven 300 yards apart and intersected at every 150 yards. No. 6, cross heading driven 160 yards; ten men working. No. 4, driven 300 yards; fourteen men working. No. 3, driven 300 yards; ten men working. No. 2, driven 300 yards; six men working; small current in Nos. 3, 4 and 6; impure with black damp; not enough current anywhere to move the anemometer; drainage good.

Steibs & Co., above Monongahela City. This mine is worked by three cross headings driven into the hill from the outside parallel; three openings; no artificial ventilation; 75 miners, six day hands and six mules. No. 3, cross heading driven 107 yards; nine men working; no current perceptible; it is connected by an air course with No. 2; considerable black damp noticed. No. 2, driven 250 yards; eighteen men working; no perceptible current; found considerable powder smoke standing; the heading is driven beyond the air course 150 yards No. 1, driven 250 yards; twelve men working; small current flowing to daylight, but heading driven about one hundred yards beyond it; air close and very much heated toward the face; drainage fair.

November 19. Robert Lynn & Co., above Monongahela City, Allegheny county. Main heading driven about 1,000 yards; ventilated by shaft with a basket; one opening; five cross-headings for working; employ 50 miners, three day men and two mules; main heading is single for the first 700 yards; then an air-course is started parallel at 17 yards distance from it. No. 12, cross heading, driven 140 yards; 10 men working; small current perceptible beyond which the heading driven 127 yards; air very close and heated, with considerable black damp. This entry is badly drained. No.

11, driven 240 yards; five men working; no perceptible air current; found standing smoke where miners were working; the heading was not as yet connected with the air-course leading to the shaft. No. 9, driven 230 yards to air-course; 22 men working; small current perceptible. No. 8, driven 225 yards to the air-course leading to the shaft; 16 men working; found a current at the intersection of the air-course of 125 feet per minute through an aperture five feet six inches by ten inches, showing a volume of 739 feet per minute. No. 10, driven 640 yards, but not working; drainage fair with the exception noted above.

Gillingham & —— Works, Westmoreland county. Main heading driven about 300 yards; ventilated by a fire on the ground at the bottom of the shaft; 10 openings; two cross headings; employ about 45 miners, five day men and four mules. New entry, one man working; driven 120 yards to an old entry making a hole about large enough to put a man's head through; have room for and intend to work twenty men; no current perceptible. No. 3, hill heading driven 100 yards; three men working; no connection for circulation; No. 1, continued driven — yards; 11 men working; air-course connected with No. 3; small current; heading driven 40 yards beyond it. No. 3, driven — yards; 20 men working; small current perceptible in an opening one foot eight inches by four feet; heading driven about 40 yards beyond it, with explosive gas at the face. A few months since a man was burned to death in this heading. Swamp heading driven — yards; 11 men working; small current; a few rooms working in water; not running at time of examination; drainage generally fair.

November 20. O. Meal & Co., West Elizabeth, Allegheny county. Main heading driven 1,600 yards from top of plane, in the hill now being worked 900 yards; no artificial ventilation; seven openings; worked on the block system, the headings intersected every 150 yards by an air course; seven cross headings; employ 125 miners, 12 day men and 14 mules. No. 5, driven 600 yards; 15 men working; found a current 70 feet per minute through an aperture 7 feet by five feet, showing a volume of 3,776 feet per minute. No. 7, driven 700 yards to an outlet; 30 men working; air current just enough to move the anenometer in an aperture seven feet by five feet, showing a volume of 1,400 feet per minute. No. 9, driven 450 yards; 25 men working; is ventilated by an air-course from No. 7, found a small current, but not enough to move the anemometer. This heading is driven 140 yards beyond the air-couse. There is a double face heading driven from this heading 100 yards in which there is no perceptible current and full of standing smoke from the heading men working. No. 10 driven 70 yards; 8 men working; no perceptible current; found standing smoke. No. 8, is driven 500 yards to daylight; 25 men working; found the air at outcast eight yards from daylight to be 170 feet per minute through an aperture five feet seven inches by four feet, showing a volume of 4,576 feet per minute. No. 6, driven 300 yards to daylight; ten men working; found current near the outside 180 feet per minute through an aperture five feet ten inches by five feet, showing a volume of 6,259 feet per minute; drainage good.

Homer & Roberts mine, East Elizabeth. Main heading driven 515 yards; ventilated by shaft and heat from boilers of steam pump; two openings; work now four cross-headings; employ when running full 200 miners, but at present only about 30 men driving entries and starting rooms, seven day men and seven mules. No. 2 driven 550 yards; current about enough to move the anemometer in a passage 8 feet by 5 feet 10 inches, showing a volume of 1,867 feet per minute; heading driven 150 yards beyond the air course. No. 3 driven 510 yards and is connected by an air course with No.

2; the heading is driven 150 yards beyond the air course; some explosive gas is generated at the face. No. 4 driven 448 yards; is connected by an air course with Nos. 2 and 3; is driven beyond the air course about 40 yards. No. 5 driven 316 yards; is connected by air course with No. 4; is driven beyond the air course 150 yards. No. 7 is just started and will have to be driven 200 yards before reaching the air course. There is a parallel heading driven along the main heading from the boiler shaft inward; found no current at the cut through between the two parallel headings to be 200 feet per minute through an aperture 5 feet by 4 feet, showing a volume of 4,680 feet per minute. No 1 is a cross-heading driven from the outside 506 yards; it is connected by an air course with No 2, and also ventilated by a shaft but is 185 yards beyond the shaft and air course; drainage good.

November 24. Clark's mines, near Fayette City, Fayette county Main heading, double driven 60 yards apart, 1,050 yards; ventilated by furnace; two openings; seven cross-headings; employ when full 75, at present 35, miners, five day men and seven mules. No. 1, cross-heading driven 300 yards; one man driving heading; not sufficient current to move the anemometer in an aperture 5 feet 8 inches by 5 feet; heading driven 80 yards beyond air course. No. 2 driven parallel with No. 1, fifteen yards distant; same description applies. Nos. 3 and 4 driven parallel, 15 yards apart, 230 yards; one man driving heading, in each driven 70 yards beyond air course; air heated and close with standing smoke. Williams & Walls double heading driven 15 yards apart to the distance of 662 yards; 15 men working in Williams heading; current too small to move the anemometer coming from Nos 3 and 4. Walls heading is the parallel of Williams driven the same distance; 7 men working; current from Williams heading too small to move the anemometer; air close with powder smoke and black damp. Diddy heading driven 300 yards; 12 men working; no current perceptible; air heated and mixed with black damp; drainage fair.

November 25. J. W. Reed & Co., Greenfield, Washington county. Main heading, used as a butt heading, driven through the hill 550 yards; no artificial ventilation; six openings; three cross headings; employ when full 100, at present about 50 miners, six day hands and six mules. No. 1 is a face heading driven 250 yards, 150 yards beyond an air course leading to daylight; not current enough to move the anemometer. The Divers heading, driven from No. 1 face heading, 230 yards to daylight; 12 men working; not current enough to move the anemometer. Face heading No. 2 driven 330 yards. About 103 yards from main heading the Hammond cross heading is started and driven 150 yards; works eight men; no connection for ventilation. Headly heading, parallel to Hammond heading and forty feet from it, driven to daylight about 150 yards; nine men working; current too small to move the anemometer; air course from face heading No. 2, driven 65 yards beyond the air course. Ice Cream heading, driven about 100 yards; works three men; no connection for ventilation; mine not running at time of examination; drainage good.

Leadbeater & Co., Greenfield, Washington county. Main heading driven about 350 yards, double the last 210 yards; two openings; cross headings; employ 35 miners, four day hands and two mules; about 100 yards from the pit mouth, there is a face heading driven about 150 paces, 90 yards beyond the air course. No 4, driven 80 yards; works 42 men; no connection for ventilation. No. 3, driven 190 yards; works 12 men; no current perceptible; main heading continued from the face heading as a double heading, No. 3 being its parallel 250 yards; no connection for ventilation. We found no current anywhere in this mine to move the anemometer; ventilation claimed to be produced by a small furnace. The distances above

given are estimated from our observation, as we could not get information, the mining boss not being found.

Dexter mine, Greenfield, Washington county. Main heading driven 360 yards; no artificial ventilation; —— openings; three cross headings driven 70, 100 and 150 yards respectively; employ when full, 45 miners; no system or indication of system of ventilation found anywhere in these mines, consequently no circulation of air; drainage fair. Not running at time of examination.